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CIVIL ENGINEERING.

Steam Navigation.

Through the courtesy of the Hon. George Bancroft, Secretary of the Navy, we are enabled to lay before our readers, part of a large mass of very valuable information upon the subject of steam navigation, in the possession of the Navy Department. It is contained in replies to a circular of the Board of Navy Commissioners, which was addressed to many practical men, as well as to other persons, and men of science supposed to be conversant with the subject.

The great importance of the subject would make these letters interesting at any time; but at the present moment, when public attention is directed to ocean navigation, and our citizens are about to contend with the English for a share at least of a trade which has heretofore been exclusively their own, the value of such information will be more fully appreciated. The projected mail steamers to Cowes and Bremen, and other ports; the Liverpool packets, with auxiliary power, and the proposed increase of the steam navy of the United States,—lend force to this remark, and give to the subject an unusual importance at the present time.

These letters were written in 1841, nearly five years ago, and great and radical changes have since been made in the arrangements of steam vessels. The old English marine engine, with side levers

and paddle-wheels, then in almost universal use, first gave place to various kinds of direct action engines, and now the old time-honored paddle-wheel itself seems about to be superseded, for marine purposes, by various kinds of oblique propellers. To the genius of Ericsson in this country, and the perseverance of Mr. B. F. Smith in England, this change is due; and the new systems introduced by them seem destined to effect a complete and speedy revolution in ocean navigation.

It is therefore highly desirable, that more recent information than that contained in these letters, should be obtained, and it is hoped that they may arrest the attention, and enlist the pen, of some one who may have the leisure and inclination, as well as the ability, to do the subject justice. Perhaps the writers of the letters may themselves be disposed to furnish such additional information as subsequent experience may have taught. COM. PUB.

Hon. GEORGE BANCROFT, *Secretary of the Navy.*

SIR:—I am requested by the Publication Committee of the Franklin Institute, to address you on a subject of interest to the science and arts of our country, especially at this time, when the commercial communities are about to associate themselves with the Government in the construction of steamers suitable for war as well as commercial purposes.

In the year 1841 or '2, the Navy Commissioners addressed Circulars to Engineers, and others having competent knowledge, requesting their views on all points relating to ocean navigation.

These inquiries were replied to, and a mass of valuable information was freely given to the Department.

The object the Institute have in view is to spread before the public these communications, or such of the information contained in them as may be of importance.

To that end I have been instructed to apply to you for the documents in question (which shall be carefully preserved and returned) with permission to publish them in the Journal of the Franklin Institute. That Journal being the only medium of publication for subjects exclusively connected with science and the mechanic arts, in the United States, it is hoped that you will accord with the Committee in the utility of their publication, and the appropriateness of the channel.

I am, with great respect,

S. V. MERRICK,
President Frank. Inst.

NAVY DEPARTMENT, *March* 9, 1846.

SIR:—Yours of March 4th has been received. Many and voluminous reports were elicited by the Circular to which you refer, which the rules of the Department do not allow to be withdrawn from its files:

but every facility will be extended to any one that you may select to make copies of those portions which you think of sufficient importance.

Respectfully yours,

GEORGE BANCROFT.

S. V. MERRICK, Esq., Pres. of the Frank. Inst., Phila.

Circular of the Board of Navy Commissioners relative to Steam Navigation, and Replies thereto.

NAVY COMMISSIONERS' OFFICE,
3rd September, 1841.

Gentlemen,—The Commissioners of the Navy, being engaged in providing an additional steam force for the Navy, which has been authorized by a late act of Congress, are desirous of availing themselves of the most approved and efficient plans of engines, boilers, and their fixtures. With a view to gain full information upon these subjects, they have taken the liberty of addressing this letter to some of the scientific and practically informed gentlemen of our country, requesting their aid on the occasion—persuading themselves that the information desired will be willingly afforded.

They beg to be favored with your opinion upon the following points particularly:— 1st. As to the horse-power of the engine. 2nd. The kind of engine. 3rd. Should this be single or double? 4th. Should it be high or low pressure?

It is believed that high-pressure engines may be used on board ships to advantage, by saving room, diminishing cost, and decreasing the labor. It is proposed to have them calculated for vessels of three sizes. As their burthen is not yet determined, the Commissioners would observe, that 500 tons will be the least, and 700 the highest limit, to which it is proposed to go in their construction; and they would be pleased to have an estimate for a vessel of 600 tons also.

Information as to the best form of the boiler, and as to the working of the different descriptions of engines; the horizontal, vertical, and angular, will be very acceptable. Indeed, any information upon any branch of the subject, which you may be disposed to communicate, will be thankfully received. You can best judge as to the information necessary to enable the Board to come to a satisfactory decision upon a subject so deeply interesting to the whole community; and the Commissioners beg the favor of you to afford it--not considering yourself in any degree restricted to the points indicated.

I am, Gentlemen,

Very respectfully,

Your obedient servant,

L. WARRINGTON,

For the Board of Navy Commissioners.

To the Navy Commissioners of the United States.

Gentlemen,—Your Circular of the 3rd inst. was duly received, asking our opinions upon the several questions propounded in relation to steam power in ships for the Navy. We cheerfully submit the following reply, though we do so under disadvantages, from a want of a more specific description of the length, breadth, and draft of water of the vessels to be employed.

Assuming a vessel to be of 600 tons, we propose double engines, with an aggregate power of 120 horses. The question of preference as to high or low pressure engines for marine purposes, we are unable to decide with our present experience. We would, however, recommend high-pressure, vertical engines, as an experiment of the form and arrangement of the model engines recently designed and made by us for Commodore Stewart, of the Navy, which are now at the Navy Yard in this city.

The advantages resulting from engines of that arrangement, particularly that with the vibrating piston rod, is a great saving of room and weight, great simplicity of machinery, and diminution of cost and labor in getting it up. Some of these advantages, particularly the simplicity of machinery, is less evident in a small model than in a full-sized engine, arising from the necessarily distorted proportions of so small a machine. Should the Commissioners examine these models, it will afford us much pleasure to attend and give such explanations in relation to them as may be required. The same arrangement is equally applicable to low-pressure engines, requiring in addition only the necessary condensing apparatus, which is readily arranged without a sacrifice of room. In recommending this engine in a vertical position, it is presumed that the power is to be applied to an ordinary paddle-wheel. We will remark, however, that the same arrangement of the piston can be placed in a horizontal or an angular engine, producing the same proportionate advantages of lightness, simplicity, and economy of room, which it does in a vertical engine.

Should it be desirable to adopt the submerged paddle-wheel of Lieut. Hunter, of the Navy, which in our opinion possesses many important advantages for a ship-of-war, or the spiral propeller, our vibrating rod can be readily applied to them.

No specified plan of boiler appears yet to have been decided upon for steam vessels, as preferable to all others. That which we prefer for high or low pressure, is cylinder boilers, with fire-places passing under them, and thence through a large number of return tubes of two to three inches diameter. This arrangement gives great efficiency, compared with the weight and size of the ordinary boilers, is not subject to injury in the tube, from excessive heat, and is readily repaired by ordinary workmen, when repairs are required.

We do not hesitate to express the opinion that engines of this arrangement, either high or low pressure, can be made with a saving of 33⅓ per cent. of room, cost, and weight, with equal efficiency when compared with engines of ordinary arrangement.

As to the angular engines, they are only adopted when the arrange-

ment of the machine requires more space in the line of power, than can be attained in a vertical position between the kelson of a ship and the cranks, or shaft. No other advantage, it must be observed, results from this position, and it is evident that more space is occupied by it in a ship than by a vertical engine.

A single engine could be made of 120 horse power, which would occupy less space, and be made for less cost, than double engines of the same aggregate power; but it is believed that the uniformity of motion produced by double engines geared together at right angles, particularly in a rough sea; and safety, in case of accident, by working one engine, while the other is being repaired, overbalance all disadvantages which can be urged against the double engine.

It will always afford us much pleasure to reply to any communications from the Government Departments, upon any subject upon which it is presumed we can give information.

Respectfully submitted.

(Signed,) BALDWIN & VAIL.

Philadelphia, September 28, 1841.

DAVID CONNER, Esq., *Navy Commissioners' Office, Washington City.*

SIR:—Your communication of the 3rd September came duly to hand;—being absent from home is the cause of not answering in due time. I am now making a drawing for a steam engine suitable for a vessel about 600 tons, calculating the hold to be 16 feet, and the draft of water, say, from the bottom of the plank, 12 feet; weight of engine, boilers, water, &c., 112 tons. The cylinder is upright or vertical, and is directly under the water-wheel shaft; the piston-rod working through the bottom of the cylinder, connecting there to a cross-head with a connecting-rod on each side of the cylinder, to the cranks on the top of the same. This form of engine is the plainest that can be constructed of a low-pressure kind; of which you will be best able to judge yourselves. One of this plan can be put up on board of a vessel of the same power, as is now putting up on board the Mississippi, for about one half the expense, and will be one third lighter. The cylinder is 54 inches diameter, with a stroke of 6 feet 3 inches, and is 211 horse power.

It is the same plan I had intended to make a working model on, at the time you were about making proposals for the two large steamers now building. I shall take great pleasure in giving you all the information I am able, according to your letter above referred to, of which I will be able to forward in all next week, together with the drawing of the same.

Your obedient servant,

(Signed,) THOS. HOLLOWAY.

Philadelphia, Oct. 1, 1841.

To the Navy Commissioners.

GENTLEMEN:—In your letter of the 3rd September, you ask for information on several points; I shall take great pleasure in communicating freely all the information I am able.

1st. Your inquiry as to horse power, &c. The horse power is so variously stated and differently calculated, it is a matter in question what a horse is equal to in power per day, hour, or minute. Suppose a horse to be able to draw 200 pounds at the rate of 2½ miles in the hour, or 220 feet per minute, with a continuance, drawing the weight over a pulley. Now $200 \times 220 = 44{,}000$, at one foot per minute, or one pound at 44,000 feet per minute. This will shew that 44,000 is the divisor for a horse power.

To calculate the power, find the area of the cylinder, multiply that by the effective pressure of the steam; say 10, 15, or 20. I say 15 pounds, the product is the weight the engine can raise, or press in, or resist in the water. Multiply this weight by the number of feet in length the piston travels in a minute, which will give the momentum or weight the engine can lift, press, or resist in the water, one foot per minute. Divide this by 44,000, and the quotient will be the horse power the engine is equal to.

On this sheet of paper I have calculated the power of the engine of which I made the drawing, 54 ins. diameter, and 6 feet 2 in. stroke.

2nd. My opinion is decidedly in favor of a low-pressure engine. It has proved to give more power than the high-pressure, when carried to great extremes, and is much more safe, more pleasant to work, and a greater saving of fuel, and has several advantages over the high-pressure. This has been fully tested on the Lakes, when on a large scale.

3rd. One engine placed in the centre of the ship will be a saving, on the first cost, of about one third, and less hands will keep it in order, takes less room, much less in weight—more particularly a large engine on the plan on which I have suggested, is much the best. *This engine* has this advantage—the power is called a direct power within itself.

The English engine, say the *Great Western*, the power is conveyed in an indirect form by side-lever beams, in which case the power passes through the ship, or through a great, massy, iron framing; is a very complicated engine, and has much friction to overcome.

Respecting Boilers. The plainest boiler is the only safe one that can be used in salt or sea water,—a boiler that can be got at on all the water side or surface, as that requires to be got at to be often cleaned. The fire surface also requires to be got at to keep it clean from soot and ashes; and it is necessary that a boiler should be so constructed that the workmen can with ease repair it, when repairs are wanted.

The Boiler I have given the outlines of, is what I call a zig zag entry boiler. It gives a large fire surface, and exposes much water to the heat. This boiler has a water bottom, on which the middle legs are riveted; this bottom is where the settlings are taken out. The boiler, although large, (say 16 feet 11 inches wide,) is just as strong as though it was 8 feet, for you will perceive it has two complete arches. By so forming, it can be put between decks, which is another advantage. With one boiler there will be less fuel consumed than with two.

I am in favor of an iron boiler. It is a boiler on which you can depend, and if tight, will last nearly as long as a copper boiler. I have built several boilers on the plan mentioned, several years back, without water bottoms, which is an improvement both to getting at or discharging the sediment, and the manner it strengthens the upright legs; the boiler consumes but a small proportion of fuel, compared to some others. There is a boiler now running on the Delaware which has been in use 11 years, and is considered by the owner to be as good as any one on the river at this time.

My method of proportioning the boiler to the cylinder in fire surface is as follows:—When a boiler is made of good proportion *as respects the draft*, and the fire surface being so that the fire can act on it; when there is 6½ feet surface allowed for every horse power, taking the within calculation, it will be sufficient even with indifferent fuel. This boiler will consume per hour 7 to 10 pounds, according to the strength of the coal.

An upright perpendicular cylinder is much the best. The friction is less, and the engine less liable to work itself out of order. An horizontal engine is the next best; but it has much friction to overcome, and is liable when put up on a large scale to work itself out of order; besides it takes more room in the vessel.

An angular engine is one of the worst; it cannot be balanced even; it is difficult to place the valves to it, without a loss of steam; and on the whole has many very bad qualities.

On this engine of mine perhaps you will inquire how it is to be packed, as the engine connecting shaft is directly on the cylinder top. There may be two large man doors on the top that can be taken up with half the trouble of lifting the whole top, and the men can pack the cylinder inside, when on the bottom centre.

I am, &c.,

(Signed) THOS. HOLLOWAY.

Philadelphia, Oct. 11, 1841.

A steam engine the cylinder of which is 54 inches in diameter with a stroke of 6 feet 2 inches, making 23 double strokes per minute.

Area of the cylinder . . .	2290
Carrying 15 lbs. of steam in boiler . .	15
	34350
12 feet 4 in. × 23 (the number of double strokes) =	283½
44,000) 9738225 (	221⅛

To COM. L. WARRINGTON, *Navy Comm'r, Washington City.*

Sir.—On my return from the survey of the boundary between the United States and the British Provinces, I had the honor to receive your letter of 3rd September, requesting my opinion on certain points

relating to the plans of steam vessels. While I fully appreciate the compliment which is paid me by considering that any hints from me would be of value to the Board of Navy Commissioners, I am only in return expressing my regret that my time is so fully occupied for the present in the service of a co-ordinate department of the government as to preclude my replying in so full and ample a manner as I could have wished. To give a reply which would be properly satisfactory, would include a draft of a vessel and engine. So far, however, as my leisure and existing circumstances will permit, I beg leave to state my views on the points you have submitted to me.

1st. In relation to the horse power of the engine, that term is so extremely vague, and the application of the usual mode of estimating the tonnage of vessels to steamers, so loose that I cannot reply in express terms to this question.

2nd. I consider that for a ship of war, an engine composed of two inclined cylinders, working at right angles to each other upon the same shaft, would be the best, in consequence of its occupying the least room, and having all its most important parts below the water line. One of the cylinders would be most conveniently placed before, the other abaft the shaft. In bringing this subject before the engineers, and naval constructors to whom the plan of the vessels will finally be committed, I would venture to suggest an idea I have long dwelt upon, and which I believe is capable of advantageous practical application. It is a fact ascertained from universal experience, that, in absolute contradiction of all theory, every foot which can be added to the velocity of the circumference of the paddle wheel gives an additional foot to the speed of the vessel. Our engineers have hitherto sought to attain this object by increasing the speed of the piston, and augmenting the diameter of the water wheel. So far as mere speed has been the object, this method has been successful, but the success has been attended with two obvious defects. (1.) The piston is driven at such a rate that the efficient pressure of the steam is much diminished, and hence the resistance which is overcome is very far beneath the estimate of the force of the engines in horse powers by the usual formula. (2.) The wheel has been increased to such a diameter as to render the vessels crank, and would in a vessel of war expose an enormous surface to an enemies' fire.

I conceive that by recurring to the original form of Watts' engine, in which the sun and planet wheel was employed instead of the crank, these objections might be obviated. The property of this apparatus is to give to the shaft of a given engine twice as many revolutions as are given by a crank. A wheel of half the diameter, therefore, if thus driven, would have the same velocity at its circumference, as one of the ordinary dimension if driven by a crank; or, a piston moving with half the speed would give an equal velocity to a given wheel. It will be obvious that in planning a new engine both of these might be partially accomplished. The piston might be made to move slower, and the diameter of the wheel lessened, each to a limit less than half of what would be adapted to the use of the crank.

3rd. In my reply to the second question, I have proposed an engine consisting of two cylinders. This has, in ordinary cases, the advantage of much greater regularity of motion, causing less strain upon the vessel, and less wear in the engine itself. In a war steamer it would be further useful, as it would be possible to construct the engine so that either cylinder might be used independently, and thus, in case of an accident happening to one, the vessel would not be wholly crippled.

4th. The high pressure engine has the advantage of simplicity, and of being of less size and weight than the low pressure engine. It has also the advantage of giving a greater power with a given expenditure of fuel. The first of these advantages is counter-balanced by the increased risk with which its action is attended, and the second ceases altogether when the condensing engine is driven by steam of medium pressure, acting expansively. It is a matter of strict mathematical calculation, confirmed by the experience of the pumping engines of Cornwall, that steam working at a pressure of 56 pounds and cut off at one-eighth of the stroke, will do twice as much work in the same engine, at the same expense of fuel, as when it is used at a pressure of 2½ pounds, and not cut off. On the other hand, in order that a high pressure engine shall have double the force of a low pressure engine of equal dimensions, it must be worked with steam of a pressure of 300 pounds. I should, however, consider that steam of 56 pounds is rather beyond the limit of safety, as the inattention of a few minutes might raise it to an explosive height, and should advise that the boilers be calculated to bear about 30 pounds per inch, and the steam cut off at one-fourth of the stroke. In respect to the form of boilers, I should consider that borrowed from the locomotive engine as superior to any other, and that it ought to be furnished with a blower to adapt it for the burning of anthracite coal. I would also recommend that each boiler have a small separate engine for supplying it with water while the main engine is, from any cause, thrown out of action.

Such, sir, are the points on which I am at present prepared to give an opinion, and it would give me pleasure at some future period to reply at greater length to the important questions you have proposed.

I am, &c.,

(Signed.) J. Renwick.

Columbia College, New York, Oct. 4, 1841.

To Com. Lewis Warrington, *Board of Navy Commr's., Washington.*

Sir—Your letter of 3rd. September last was received. The reply has been delayed by an attack of fever and ague, which I must beg you to receive as an apology for the apparent neglect.

1st.—The first point on which information is desired, relates to the horse power of the engine.

This query is not altogether definite,—whether referring to the estimate of horse power, as used in this country, compared with that

used in England, or the comparative horse power in regard to the tonnage of the steamers. I shall therefore first endeavor to give you a simple explanation of the horse power of steam engines, and the basis of the calculation.

In order to form an accurate estimate of the power necessary to drive machinery of various kinds, saw mills, grist mills, cotton factories and subsequently steam boats, it occurred to Mr. Watt, who brought the steam engine into practical use, to fix upon an unit of power, and as horses were much used for driving machinery, the power of a horse was chosen as the unit. After various experiments he decided the average working power of a horse to be equal to raising 33,000 pounds avoirdupois, over a pulley one foot high in one minute of time.

This force has subsequently been adopted as the unit, or horse power, in most of the books on mechanics, and is used, whether the propelling force be wind, water, or steam; and the principle of the calculation is to reduce the whole force exerted into pounds weight, moving at the rate of one foot space in one minute of time, which divided by 33,000 pounds, the unit, or horse power, gives the number of horses power exerted; and this compared with the number of horses power required to perform the duty desired, enables the engineer to regulate the power of his machinery, to produce the result required. In estimating the power of the steam engine, it evidently rests upon two points; first the effective pressure, or actual force in pounds exerted on the piston, after deducting the waste of friction and loss of power of the steam by the radiation of heat from surfaces exposed to the atmosphere, together with the resistance of the atmosphere against a vacuum.

Secondly, The speed at which the force of steam on the piston is capable of moving the piston,—these two requisites, viz. effective pressure on the surface of the piston, taken in pounds on the number of square inches contained in the piston, combined with the velocity *in feet* per minute at which the piston moves, form the total power of the engine, which divided by the unit of power of one horse, or 33,000 pounds, gives the number of horses power; from which results the simple formula.

To ascertain the number of horses power of a steam engine, multiply the area of the piston in square inches by the effective pressure on each square inch of the piston, and the product by the velocity or number of feet per minute the piston moves.

The result is, the full force exerted, taken at the velocity of one foot per minute, and divided by 33,000, gives the number of horses power; in other words—D, diameter of cylinder in inches; F, effective force in pounds or square inch of cylinder; V, velocity in feet per minute at which the piston moves; the theorem then follows, $D^2 \times .7854$ area of cylinder or piston in square inches.

V, Velocity, length of stroke in feet multiplied by the number of strokes per minute, multiplied by *h*, for the up stroke and the down stroke, equal the number of feet passed through in one minute of time.

A, Area of cylinder in square inches, multiplied by F, the product multiplied by V, and the whole divided by 33,000, number of horses power, $\frac{A \times F \times V}{33{,}000}$ = number of horses power.

In England it has been the custom to use steam for condensing engines at a very low pressure, about 2 pounds to 3 pounds on the square inch of the safety valve, resting the chief dependence for power on the force of the vacuum, which in well constructed steam engines exerts a force of 13 to 14 pounds on the square inch of the piston, without allowance for waste or friction. This plan of working was found to be most economical in regard to consumption of fuel, and also in the duration of the engine, as the joints were less liable to be put out of order, than with a higher pressure; and working at this low pressure, the effective force of steam was the *same* in all cases.

The effective force of steam exerted on the piston has been variously estimated, from 7 to 9 pounds on the square inch of piston, but I am inclined to think that a medium between the two, or 8 pounds pressure effective, will not be found too great in engines at 5 pounds pressure on the square inch of boiler, as shown by the safety valve, or steam mercurial gauge, and shall adopt 8 pounds as the effective pressure in the calculation of the English condensing steam engines working with the government regulation of safety valve, one of which is under lock and key and opens at a pressure of 5 pounds on the square inch. The speed of the piston is generally taken as the same where the length of crank or stroke is the same, and with 7 feet stroke, the longest used in the British marine engines, 15 revolutions are allowed, making the velocity in feet per minute at which the piston moves, 15 double strokes, or 30 single strokes of 7 feet = 210 feet per minute, which is the speed of the pistons of the Great Western Steam Packet which has now run for three years with most extraordinary regularity between this city and Bristol, England.

The ingenuity of American engineers (who choose to think and judge for themselves without regard to the laws established by Messrs. Bolton & Watt, which English engineers do not venture to question or swerve from) discovered that steam of a high pressure used expansively, (that is the full force of the steam in the boiler suffered to act upon the piston for a certain portion of the stroke, then shut off, and suffered to expand for the remainder of the stroke, after the communication with the boiler had been shut off, by a very simple contrivance called the half stroke or cut off valve, was peculiarly adapted for the propelling of boats) adopted the plan of working with an additional pressure of steam in the boiler.

This in the first instance, was suffered to act with full force on the piston for half the length of stroke, when the communication with the boiler or source of supply of steam was shut off, and the steam in the cylinder sufficient to continue the power for the remainder of the stroke by its known quality of expansion, which was found to be

in the direct ratio of the increase of bulk, that is, one cubic foot of steam at a pressure of 10 pounds, suffered to expand to two cubic feet, would exert a pressure of very nearly 5 pounds.

Steam used in this manner would, for one half the time, exert a power, which, if continued the whole stroke, would require double the evaporating power of boiler, while the effect in propelling a vessel, like the action of oars, would be in far greater proportion than one half; since the vessel once put in rapid motion, will by its own momentum continue its velocity through the water, very little diminished before the next stroke commences with full force of steam of the boiler.

In practice it was soon found that the engine acted with greater force by varying the position of the stroke at which it was cut off from the half stroke to the $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, and in the De Witt Clinton steamer, running on the Hudson River, I have known the steam cut off at 16 inches of the stroke while the full stroke was ten feet, equal to $\frac{2}{15}$ths of the full stroke.

In addition to variation in the position of the stroke at which the steam was cut off, the pressure of steam on the square inch of boiler was gradually varied from 3 to 10, 20, 30, and latterly I have known the boats running on the Hudson River, with condensing engines, useing steam at a pressure of 40 and 50 pounds on the square inch of boiler.

It is obvious that with so great variation in the source of power, the pressure of steam, that there could be no comparison of horse power derived from the mere diameter of cylinder and length of stroke, and the consequence has been that the use of the term of *horses power* has been abandoned with us in connexion with the boat or marine engines.

Twenty years observation and experience of the changes which have been made in the same engines and boats, by substituting cylinders of larger diameter (by which the pressure of steam used has been reduced, and this with advantage to the speed of the vessel, with the same consumption of fuel,) satisfied me that there is a limit of pressure of steam, which combines the advantage of speed with an additional security, both against the leakage of joints and against accident by the straining of boilers, which at a pressure of 50 pounds on the square inch will require more frequent repair and be more liable to leak at a less pressure.

I would venture therefore to suggest to the Board the propriety of adhering to the English plan of designating the power of the steam engine, by the established comparison of *horse power* as used in all other cases of machinery, and to enable you to hold the comparison just, in all cases, recommend that 10 pounds pressure on the square inch of the boiler be adopted as the standard or limit of pressure for the marine condensing engines of the navy, working expansively, and cut off at $\frac{1}{3}$ the length of the stroke.

This will give a constant effective pressure on the square inch of piston of about 9·9 lbs.

To render the comparison between engines of different length of stroke uniform, it will be necessary to establish the velocity in feet for the different lengths of stroke; for which object, as water wheels of large diameter are found more effective, I would propose to adopt 15 revolutions of the water wheel, as the speed for water wheels of about 30 feet diameter = 94 feet circumference at the extreme diameter × 15 revolutions per minute × 84870 feet velocity of exterior of wheel per hour, from which deduct ⅓, 28290, 56·580, or $\frac{56{\cdot}580}{5{\cdot}280}$ = 10 7-10 miles per hour through the water, the allowance of one third loss of speed is greater than will be found in practice with vessels of good model; but it is a safe allowance, and I do not think will differ much in the vessels "Missouri" and "Mississippi," now nearly ready. Taking 15 revolutions as the speed of these two steamers, the velocity of the pistons will be as follows:

Mississippi 7 feet stroke × 2 = 14 feet × 15 = 210 feet per minute.
Missouri 10 " × 2 = 20 " × 15 = 300 " "

And the calculation of horses power as compared with the Great Western Steamer will be as follows:

"Mississippi," engine working at a pressure of 10 pounds on the square inch of boiler expansively, cutting off at ⅓ the length of stroke, effective pressure on the piston 9·9 lbs, on the square inch.

Diameter of piston 75 inches, area 4418 square inches.

× by velocity of piston,	210
	927780
× by effective pressure	9·9 lbs.
- by unit of horse p'r 33000 lbs.	) 91850·220
	278·33 h. p'r of each engine.
	278·33 " " "
	556.66 " the combin'd eng's.

Steamer "Missouri," cylinder 62·72 in. diameter, 10 feet stroke, 30 strokes, working at the same effective pressure.

Diameter of cyl's, 62·75, area = 3092	
× Velocity of piston in feet	300
	927600
× by effective pressure	9·9 lbs.
33000)	9183240
	278·27 horses power of each engine.
	278·27 " " "
	556·54 " combined "

Steamer Great Western.

Length from fore part of figure head to after part of taffarel	236 feet.
Length between perpendiculars	212 "
Length of keel	205 "
Breadth in the clear, of paddle boxes	35 " 4 in.
Breadth over paddle boxes	59 " 8 "
Depth of hold	23 " 2 "
Tonnage measurement	1340 tons.
Length of engine room	72 feet.
Diameter of cylinder	73½ in.
Length of stroke	7 feet.
Diameter of water wheel	28 " 9 in.
Number of floats	4
Depth of floats	7½ in.
Length of floats	10 feet.

The ordinary pressure of steam used by the Great Western is 3½ lbs. on the square inch of boiler, and although the arrangement for working expansively is annexed to the engine, I believe the effective pressure of steam will not exceed 8 pounds on the square inch of piston.

The steam power therefore at 15 revolutions of the water wheel will be as follows:

Cylinder 73½ in. diameter — area	4243
× by velocity 7 × 2 × 15	210
	891038
× by effective pressure	8
÷ by unit of horse p'r 33000)	7182·240
	216 horses power of each engine.
	216 " " "
	432 horses p'r of combined engines.

In the logs of the Great Western's first voyage, published in Bristol on 4 July, 1838, the combined power of the engines is rated by Peter Maze, chairman at a meeting of stockholders held 2nd. June, 1838, at 450 horses power; but the revolutions per minute in the log fall short of 15, and should rate her power beyond that now stated, 432 horses.

The Great Western's tonnage is rated at 1340 tons, but I have not at the moment access to the British calculation of tonnage for steamers, in which I believe there is an allowance made for steamers, different from that of sailing vessels. By our Custom House measurement, as an ordinary sailing vessel, she would register—

Length of deck less $\frac{3}{5}$ breadth of beam × by beam × half breadth of beam ÷ 95 feet 212 — 21·19 = 190·81 × 35 ft. 4 in. = $\frac{121356}{95}$ = 1273·7 tons burthen. The proportion of horses power to the tonnage

of the vessel will therefore be 1340 tons ÷ by horses power 450 = 2·98 tons to the horse power: or 1273·7 tons ÷ by horses power 432 = 2·93 to the horse power.

The total weight of Steamer "Great Western" ready for sea, is stated at 2372 tons, and her draft of water at 2305 tons 4, 0, 25, equal to 16 ft. 8 in; which after running for 12 months will not be far short of 17 feet.

As this vessel appears to have been one of the fastest, and most serviceable that England has produced, I should be inclined to recommend her proportions of horse power and tonnage until the experience of the performance of our own steamers should furnish other data for estimating the relation between the horse power and tonnage, and would propose for large steamers, necessarily of much draft, one horse power to 3 tons of vessel; for smaller vessels the proportion of horse power to the tonnage must vary accordingly to the model and draft of water, which may be predicated on the performance of our own steamers.

The next query—the kind of engine.

The performance of the Lightall engine, as it is called, on board the steamer "Kamschatka," lately built for the Russian Government, would go to show that the objections the Board appointed in 1839 (consisting I believe of Capt. M. C. Perry, Chief Eng. Chas. H. Haswell and myself) found to this plan of engine, were well founded; and I have been strengthened in this position by the opinion of all the practical steam engineers in this place.

The comparison of the kinds of engines to be used is reduced—

1. To the British form of marine engines on board the "Mississippi."
2. To the inclined " " " " "Missouri."
3. And a very simple plan of engine, placing one cylinder forward and the other aft of the line of the water wheel and shafts—the cylinders lying at the same angle, and connected from the cross head directly with the crank pin of the crank.

The first plan has the disadvantage of a limited length of stroke, regulated by the depth of hold, which in vessels of ordinary draft and depth of hold, say 23 to 24 feet, cannot exceed 7 feet stroke to 23 feet hold. This reduces the stroke so much for vessels of light draft of water that I should prefer either of the two latter plans of engine.

The British marine engine has an additional weight of cast iron framing which increases the weight necessary for engines of the same horses power, without any equivalent, as far as I have been able to discover, as I cannot conceive the advantage of a cast iron framing, perfectly rigid and unyielding, erected upon a wood foundation, such as that of a ship, which from its nature must yield in pitching and rolling in a heavy sea.

The truth of this position has been shown by the fact of the cast iron framing of the Steamer "Great Western," and I believe every other British steamer that has entered this port, having broken in certain parts, although made of a strength which it was supposed would insure it against accident.

I am therefore of opinion that either of the two last forms of engine will be found more effective with the same quantity of fuel.

The inclined form of engine as used on board the "Missouri" possesses the following advantages over the British Marine engine:

1st, The engine is lighter by the difference between the cast-iron framing used in the British vertical, reversed beam engine, and the wood framing used in the inclined engine.

2d, The framing of the inclined engine where the cylinder is at one end of the framing, and the crank plummer block at the other end of the same pieces of framing, binds the parts more perfectly together than can be done in the British engine, inasmuch as in the inclined there are but two points to be secured against the strain of the engine, and in the British engine there are three points. In the inclined engine the two points are the cylinder and the crank plummer block. In the British engine the cylinder, the plummer blocks for the centres on which the cast iron beams work, and the crank plummer blocks.

3d, The effective power of the engine in the inclined being directly transmitted from the cylinder to the crank without the intervention of the cast-iron beams, should be greater by the difference of friction of the beams of the British engine; and having fewer journals and fewer parts, the risk of getting out of order is less than that with the British engine.

4th, The length of stroke in the inclined engine can be varied to the proportion judged most advantageous for the use of steam expansively.

5th, The wood framing of the inclined engine becomes a powerful bracing and support for the part of the vessel which has first to receive the strain of the power of the engines, and is by this means rendered the strongest part of the vessel, and least liable to change its form; while in the British engine the framing is disconnected from the sides or deck timbers of the vessel, and leaves the centre, or that part of the vessel taken up by the engine, as the weakest.

6th, The cost of the inclined engine will be less than that of the British engine.

Against these several advantages I know of but two in favor of the British engine, which is, that the piston works vertically, by which it is claimed that the cylinder will wear equally in a true circle, where the packing of the piston is readily kept tight; while in the inclined position of the cylinder, the under side of the cylinder, from the weight of the piston resting upon it, is inclined to wear in that part only, and form an elliptical surface on the lower or under side.

In practice, however, the wear of the cylinder is found to be very trifling, and not sufficient to cause a leak of steam in the packing; and even should the cylinder become worn on the under side, the ingenuity of the engineer will readily compensate the deviation from the circle by additional packing on the under side.

The weight of the piston, however, is greatly reduced in its pressure on the under side of the cylinder by the support of the piston rod, which is bound at two points; at the cross head and at the gland in the cylinder cover, and the immense pressure on the surface of the

piston will in a great measure prevent the weight of the piston from producing the effect which at first sight would be expected.

The remaining advantage of the British engine is, that it takes up less length than the inclined. The cubic feet of space occupied by the two descriptions of engines will be rather in favor of the inclined engine, as the British engine takes up the whole space of the vessel from the upper deck to the keel, for its full length, while in the inclined engine the greater part of the gun deck is available.

The third kind of engine is in reality the inclined engine, altering the position of the cylinders from side and side, to one forward and one aft the crank plummer block, in line in the centre of the vessel. The length of the vessel taken up by the third plan of engine will therefore be nearly double that of the second plan of engine, and reduce the space in width nearly in the same proportion, and the engineers in attendance on the two engines must necessarily be thrown a much greater distance apart than when the engines are placed side by side.

The third plan will however take up less length of vessel in cases where the boilers can be placed in the wings outside of the engines. But in this case the boilers, from not having the intervention of the coal bankers, will be more exposed to action of shot from the enemy.

The third form of engine dispenses with two cranks and two plummer blocks, which will reduce the weight and expense somewhat, but not to an extent to make it an object of consideration. In other respects it possesses all the advantages towards bracing the vessel which belong to the second plan of engine.

I would therefore recommend the second and third form of engine as described, in preference to any other plan which has come within my observation; the one or the other to be adopted as the beam of the vessels may render advisable.

The third query is, whether there be single or double engines? For large steamers intended to be sent abroad I should recommend two engines; for small coasting vessels, and for the Revenue service and on the lakes, I should recommend single engines.

Fourth query. Should it be high or low pressure? The high pressure engine possesses no advantage over the condensing, beyond the small difference in weight of the condensing apparatus, and the expense of these parts, which are not material in comparison with the additional power gained by the vacuum in condensing the steam. The additional simplicity of the parts of the high pressure engine is counterbalanced by the additional risk of leakage from the extreme pressure, the additional risk of accident from explosion, and, as mason work is generally used in setting the boilers, the danger of fire from the furnace is greater with the high pressure engine.

The loss of power from the use of the air pump is far short of the gain from the vacuum produced; and on the whole, for vessels, I should give the decided preference to the condensing engine over the high pressure, or non-condensing engine—in which opinion I am supported by a very large majority of the engineers of this section of the

Union, where the steam engine has been carried to higher perfection than in any part of the United States.

Form of boilers.—The form of boilers in use for boat engines for wood or bituminous coal, most approved, is in the main similar to those in the "Fulton," with water bottom and flues connected with the furnace under the boiler; thence returning in small circular flues towards the front end of the boiler, where the several flues are brought into one chamber and thence carried into the chimney.

In the "Missouri" and "Mississippi" a second set of return flues above the first have been adopted, for the purpose of bringing the draft of the four boilers into one chimney.

The flue is surrounded where it leaves the boilers by a steam chimney, and the steam is brought into contact with the plates forming the bottom of the chimney, on the outside of which the flame acts after passing through the flues of the boiler: although there may be some trifling saving in fuel by heating the steam immediately before its entrance to the cylinder, the disadvantages in the steam chimney are such that I should hesitate to recommend its use for sea steamers. In the first place, the steam chimney is found to get out of order and require repair much sooner than any other part of the boiler, as the metal at the line of surface of the water, after a short time, corrodes, and requires replacing with new plates, which cannot well be done at sea.

The steam chimney is further objectionable in a war steamer, from its rising above the level of the boiler several feet, by which it is more exposed to the enemy's shot, and if penetrated by shot, the steam escaping from the orifice would endanger the lives of all on the gun deck; since the inhaling of the steam, by scalding the interior of the lungs, is sure to cause death.

The copper steam chimney used on board the "Fulton," I am informed, shows no symptoms of wear: still I am satisfied that this will be the first part of the boiler requiring repairs.

To obviate the frequent derangement of the steam chimney, what is called a steam chamber, raised above the boiler, has been substituted, and I think is preferable. Another plan, however, has occurred to me, and in conversation with Mr. Merrick of Philadelphia, I learn that he has made a draft on the same principle, which is to carry the draft direct from the furnace into the upper tier of flues, and to return downwards at a lower level, by which means the draft will leave the boiler upwards of 3 feet lower than in the present form of boiler.

I have made enquiry from one of our most skillful ship builders in regard to the dimensions of steamers of 500, 600 and 700 tons burthen. The builders are Smith, Demon and Comstock. Smith, the engineer of the firm, who designs the models, was an apprentice of Eckford, and aided him in the modeling of the Ohio. The dimensions proposed by them are as follows, viz:

No. 1. 150 feet on deck.
27 " wide.
15 " deep. With double decks, Custom house tonnage, 513.37-100 tons.

No. 2. 165 feet on deck.
28 " wide.
15 " deep. Double decked, tonnage 611.5-100 tons.

No. 3. 180 feet on deck.
29 " wide.
15 " deep. Double decked, tonnage 719.7-100 tons.

They would build these vessels with bottom of white oak, and top of live oak and locust; copper fastened and solid floor, with suitable materials as to size and quality say for hull and spars, including block work and outside joiner work, at the rate of seventy-five dollars per ton. Sheathing copper and joiner's work below upper deck not included. For these vessels I should recommend a single inclined engine of the following dimensions, viz:

For No. 1, 513·37 tons burthen.
Cylinder 49 inches diameter, 8 feet stroke, 171 horse power.

For No. 2, 611·5 tons burthen.
Cylinder 54 inches diameter, 8 feet stroke, 204 horse power.

For No. 3, 719·7 tons burthen.
Cylinder 58 inches diameter, 8 feet stroke, 240 horse power.

The estimate of horse power is made on an effective pressure of 9·9 lbs. on the square inch of boiler, with a velocity of piston of 300 feet per minute for a water wheel of 20 feet in diameter, making 19¼ revolutions, allowing ⅓ slip or loss of speed between vessel and exterior of water wheel, will give a speed of 9 miles per hour through the water nearly,—which is ample for vessels of this size. I have not been able to form an estimate of the cost of these engines, which I presume will be supplied with iron boilers, but will be prepared shortly in case the Board desire that information.

As your letter invites me to touch on any other points which may occur to me, I would call your attention to iron steamers. For the lake service especially, they will be found far more durable than vessels of wood, and for coasters they will be more durable, and with the water-tight bulk heads, in case of getting on the rocks and bilging, they can readily be carried into port, and in dry dock repaired in a few hours at a trifling expense.

They have now been in use for several years on the Savannah river, and an annual coat of red lead is found to preserve them against rust.

Having built one steamer of iron for New Orleans at the West Point Foundry Association, we can safely say that the work can be done in this country as well as in England.

I regret that I did not meet Lieut. Hunter when here in the "Germ;" but not having examined her machinery, shall not venture an opinion.

I have spun out my reply rather longer than originally intended, but have found this necessary to give you the practical explanation

of the horse power, which appeared to me to be necessary to make the question understood by those not conversant with the subject; and if the subject be not sufficiently plainly stated, when we meet I think it can be made so by a few minutes' conversation.

I have omitted to speak of Capt. Ericsson's propeller, and also of Lieut. Hunter's wheels—your queries relating directly to the engines.

From the experiment, however, on board the "Clarion," of the effect of the propeller, in company with Capt. Perry and Mr. Rhodes, I was satisfied that the effect produced by the quantity of fuel used, was fully equal to what would have resulted from the ordinary water wheel. Whether the same velocity given by the ordinary water wheel can be produced by increasing the power, I think doubtful; but it possesses the advantage of being submerged; and I think the trials have established the fact that with great economy of fuel, a speed of 7 knots per hour can be attained, and by increasing the power, have little doubt that 9 knots can be attained. I hope therefore to see one of the new steamers constructed with the propeller.

Yours, respectfully,

(Signed) W. KEMBLE.

New York, 9th October, 1841.

[To be continued.]

Report of Edward Miller, Chief Engineer of the Schuylkill Navigation, January 1st, 1846.

To the Board of Managers—

GENTLEMEN:—On the 11th of March last, I had the honor to make a report to you on the subject of the improvement of the Schuylkill Navigation; which was based partly upon my own observations during a careful examination of the line, and partly upon a review of the plans, surveys and estimates made under the immediate direction of the President of the Company, S. W. Roberts, Esq.

In that report I expressed the opinion that the works could be vastly increased in capacity; that the locks could at the same time be reduced in number from 109 to 82; that less water would be required to pass a given amount of tonnage with the enlarged boats and locks; that the supply of water could be increased to any required extent, so as to be commensurate with any anticipated trade of the Schuylkill valley; that the cost of transportation would be reduced one half by such an improvement; that the new set of locks could be completed so as to pass boats within twelve months of the time of signing the contracts; and that the whole improvement could be finished for $1,000,000, exclusive of damages, without material interruption to the trade, by the spring of 1847.

These opinions I endeavored to sustain by arguments deduced from actual experience; by unquestionable facts with regard to the character and capacity of your own works, and by analogies drawn from improvements of a similar character.

It gives me much pleasure to say that the experience of the past season confirms the conclusions which I then advanced. All the locks

and the most difficult sections of earth and rock work are under contract, and the measurements have been made and the cost calculated with minute detail, and it is now manifest that the former estimates were more than sufficient to have completed the improvements contemplated in the reports of Mr. Roberts and myself.

The Engineer corps was organized in the month of May, by the appointment of three Resident Engineers, each of whom had two assistants.

The upper division, extending from Port Carbon to the outlet of the Hamburg Canal, 31½ miles, 353½ feet lockage, was placed under the charge of Ellwood Morris. The central division, extending from the outlet of the Hamburg Canal to the outlet of the Girard Canal, 39½ miles, 162½ feet lockage, was placed under the charge of Antes Snyder. The lower division, extending from the Girard outlet to tide water, 37 miles, 103½ feet lockage was placed under the charge of James F. Smith.

All these gentlemen have fulfilled their duties with skill and fidelity.

The contracts for the locks were signed in the latter part of May and in June. Great difficulty was experienced in procuring at so late a season the very large amount of timber and plank required, on account of the summer drought which prevented most of the saw-mills from cutting lumber, and also interposed obstacles in the way of getting it to the works.

The necessity of keeping up the navigation where one lock was taken down and rebuilt by the side of another in daily use—especially in the case of the flights of combined locks, where the new foundations were sunk to a considerable depth below the others, and were consequently exposed to heavy leaks into the pits,—caused much inconvenience; this part of the work, however, was accomplished without disaster, and without stopping the trade.

The abandonment of some of the contracts made with parties whom we believed to be responsible, has produced detention in particular cases.

But notwithstanding these difficulties the works have generally progressed satisfactorily, and a very large and important portion is done. The materials for the remainder, except where they are to be procured in the immediate vicinity, are generally delivered or within reach, and if we are favored with an open winter, all that was promised in point of time will be more than realized.

In the course of our detailed and accurate examinations, it was soon found that improvements were practicable which had not been anticipated in the previous reports; and that important advantages were attainable within the general scope of our plans and views. The value of these changes will be appreciated when it is known that the number of locks which was before 109, and which we expected to reduce to 82, will now be only 70; and that two dams have been dispensed with, and wide canals substituted for the pools. These changes have made considerable amounts of earthwork necessary, and have increased, though not very materially, the cost of the whole line.

It was my intention to have entered into a particular description of the principal modifications and improvements which have been adopted; but I find that it would be difficult to make them intelligible without maps; and that even a concise statement of them would swell this report to a most unreasonable length. My special reports to the Board, and those of the Resident Engineers to myself, which are herewith submitted, contain all the details which can be desired on these points, together with carefully prepared estimates of the cost of the improvements, generally calculated at contract prices. Where these were considered insufficient, or where the work was not under contract, such prices have been taken as are deemed sufficient to cover contingencies.

The estimates are made for one complete set of locks, and an enlargement of the canal throughout to 40 feet bottom width and 5½ feet depth.

In earth excavations the minimum surface is intended to be 56½ feet, a very large portion being much wider. Near the locks, and at all points where boats congregate, wide reaches are to be provided. In rock excavations, the sides will be cut as steep as the rock will stand. Where the canal is much curved a greater width on bottom than 40 feet will be given.

The estimates also include the new Vincent Dam, a structure of great strength and excellence, now nearly completed, which will take the place of a decayed and imperfect work; also raising dams, towing paths and bridges; deepening river channels; building new bridges, and altering, enlarging and improving the mechanical structures where necessary. A considerable portion of these items, might with propriety be passed to the repair account, as similar expenditures would have been soon required in order to keep the old works up. Others, such as raising guards to give greater safety against floods, &c. are improvements which would have been highly important and desirable if no general plan of enlargement had been determined.

I had hoped and believed that a large portion of the expenditures for the enlargement of the Canal could, without inconvenience, be postponed until the winter of 1846–7, and that a partial improvement, omitting the most expensive portions, or making only occasional passing places, would answer for next season. With this view the Resident Engineers were directed to make a separate set of estimates and measurements, from which it appeared that the points, which on account of their narrowness and abrupt curvature imperatively require immediate enlargement, are the most costly portions of the work, being those parts which, on account of their great expense, have received least improvement since the construction of the Canal. When to these are added the changes and improvements consequent upon the rearrangement of the locks already alluded to, the remainder becomes so small that it seems bad policy to run the risk of crippling the business, even of one season, in order to postpone it. I advise therefore that the widening of the remainder of the Canal throughout, and the deepening of it so far as the same is practicable in winter, be imme-

diately put under contract, and pushed forward to completion in the most energetic manner.

Referring again for minute detail to the estimates of the Resident Engineers, I subjoin a brief summary of the cost of the improvements, condensed from their statements, and compared with the original estimate of Mr. Roberts.

	Upper division, Ellwood Morris.	Central division, Antes Snyder.	Lower division, James F. Smith.	Totals of present estimates.	Estimates of Mr. Roberts.
Locks, Lockpits, Pumping, Bailing, &c., connected with these items.	$387,893	130,830	109,109	627,832	592,000
Enlargement of Canal, including improvement of Dams, Pools, and Mechanical Structures.	153,737	128,495	108,025	390,257	488,000
Totals.	$541,630	259,325	217,134	1,018,089	1,080,000

From the above it will be seen, that the aggregate of the estimates of the Resident Engineers is $61,911 less than the amount named by Mr. Roberts, a sum nearly sufficient to cover the cost of damages, which are not included in the present statements, as they do not come into the Engineers' account. A careful revision satisfies me that they are made on proper principles, and that they contain generally liberal allowances for the contingencies likely to arise; for additional security, however, I propose to add $36,911, making the whole cost, exclusive of damages, $1,055,000.

The whole amount of work done and materials furnished for the improvement of the Navigation, as appears from the estimates of the Resident Engineers to this date, Jan. 1, 1846, with some accounts for materials purchased not included in the estimates, is	$ 249,956·15
Salaries of Engineers, instruments, office expenses, stationary, printing, and sundries,	12,054·76
Amount of Samuel Griscom's account for manufacturing and delivering cement, and sundry other expenses connected with the improvement, not passed through my books,	9,549·53
Cost of improvement to Jan. 1, 1846,	$ 271,560·44

The whole amount of my warrants drawn in favor of Contractors, Superintendents and others, for work done and materials furnished,	218,666·69
The amount of my requisitions for engineering expenses,	11,648·30
Total,	$ 230,314·99
Amount of retained per centage to insure the faithful performance of contracts,	$ 31,289·46

All which is respectfully submitted.

EDW. MILLER,
Chief Engineer Sch. Nav.

Report of ROBERT STEPHENSON, *Esq., Chief Engineer on a Railway Bridge across the Menai Straits.*

To the Directors of the Chester and Holyhead Railway.

Gentlemen—In reporting to you the progress which has been made in the works, I beg to refer you to the statements of Mr. Ross and Mr. Forster, made from time to time, as regards those under contract. In addition, I need only state, that last week I examined them personally, and found the whole progressing in the most satisfactory manner. I will therefore proceed at once to lay before you the results of the experimental investigation which, with your sanction, I commenced some months ago in reference to the construction of the bridge over the Menai Straits. The object of this investigation, as you are aware, was to test the truth of the views I entertained respecting the employment of a large wrought-iron tube, instead of cast iron arches, as was originally proposed; but which we were compelled to abandon, in consequence of the Admiralty refusing to allow the erection of such a structure, from the belief that it would injuriously interfere with the navigation of the Straits. In conducting this experimental investigation, I saw the importance of avoiding the influence of any preconceived views of my own, or at least to check them, by calling in the aid of other parties thoroughly conversant with such researches. For this purpose, I have availed myself of the assistance of Mr. Fairbairn and Mr. Hodgkinson; the former, so well known for his thorough practical knowledge in such matters, and the latter, distinguished as the first scientific authority in the strength of iron beams. These gentlemen have pursued the subject with deep interest, and although they have not yet been able to bring the facts into a final and definite shape, they have each complied with my request, that they would communicate their views upon the results which have already been arrived at. I therefore append to this report, their observations just as I received them. They will, I am confident, prove satisfactory to you. I have throughout the experiments carefully studied the results as they developed themselves, and I am satisfied that the views I ventured to express twelve months ago were in the main correct, and that the adoption of a wrought-iron

tube is the most efficient, as well as the most economical description of structure that can be devised for a railway bridge across the Menai Straits. In the course of the experiments, it is true, some unexpected and anomalous results presented themselves; but none of them tended in my mind to show that the tubular form was not the very best for obtaining a rigid roadway for a railroad over a span of 450 feet, which is the absolute requirement for a bridge over the Menai Straits. The first series of experiments was made with plain circular tubes, the second with eliptical, and the third with rectangular. In the whole of these, this remarkable and unexpected fact was brought to light, viz: that in such tubes the power of wrought iron to resist compression was much less than its power to resist tension, being exactly the reverse of that which holds with cast iron; for example, in cast iron beams for sustaining weight, the proper form is to dispose of the greater portion of the material at the bottom side of the beam, whereas, with wrought iron, these experiments demonstrate beyond any doubt, that the greater portion of the material should be distributed on the upper side of the beam. We have arrived, therefore, at a fact having a most important bearing upon the construction of the tube: namely, that rigidity and strength are best obtained by throwing the greatest thickness of material into the upper side. Another instructive lesson which the experiments have disclosed is, that the rectangular tube is by far the strongest; that the circular and eliptical should be discarded altogether. The result is extremely fortunate, as it greatly facilitates the mechanical arrangements for not merely the construction, but the permanent maintenance of the bridge. We may now therefore consider that two essential points have been finally determined; the form of the tube, and the distribution of the material. The only important question now remaining to be solved, is the absolute, ultimate strength of a tube of any given dimensions. This is of course approximately solved by the experiments already completed; but Mr. Hodgkinson very properly states, that others, with tubes of more varied dimensions, should be continued in order to clear up some anomalies which still exist. The formula, as at present brought out by Mr. Hodgkinson, gives the strength of a rectangular tube of the dimensions I proposed, viz: 450 feet long, 15 feet wide, by 30 feet high, (assuming the plates to be one inch thick,) equal to 1,100 tons applied in the centre, including the weight of the tube itself, but deducting the latter, equal to 747 tons in the centre, or double this, supposing the weight to be uniformly distributed over the whole 450 feet. This amount of strength, although sufficient to carry any weight that can in practice be placed upon the bridge, is not sufficiently in excess for practical purposes. It is on this ground, therefore, I have requested Mr. Hodgkinson to devise a few more experiments in the shape best calculated to free the formula from all ambiguity. In the mean time, however, as I consider the main question settled, I am proceeding with the designs and working plans for the whole of the masonry, which I expect to have the pleasure of submitting to you in a fortnight from this time. You will observe in Mr. Fairbairn's remarks, that he contemplates the feasibility of strip

ping the tube entirely of all the chains that may be required in the erection of the bridge; whereas, on the other hand, Mr. Hodgkinson thinks the chains will be an essential, or at all events, a useful auxiliary, to give the tube the requisite strength and rigidity. This, however, will be determined by the proposed additional experiments, and does not interfere with the construction of the masonry, which is designed so as to admit of the tube, with or without the chains. The application of chains as an auxiliary has occupied much of my attention, and I am satisfied that the ordinary mode of applying them to suspension bridges is wholly inadmissible in the present instance; if, therefore, it be hereafter found necessary or desirable to employ them in conjunction with the tube, another mode of applying them must be devised, as it is absolutely essential to attach them in such a manner as to preclude the possibility of the smallest oscillation. In the accomplishment of this I see no difficulty whatever: and the designs have been arranged accordingly, in order to avoid any further delay. The injurious consequences attending the ordinary mode of employing chains in suspension bridges, was brought under my observation in a very striking manner on the Stockton and Darlington Railway, where I was called upon to erect a new bridge for carrying the railway across the river Tees, in lieu of an ordinary suspension bridge, which had proved an entire failure. Immediately on opening the suspension bridge for railway traffic, the undulations into which the roadway was thrown, by the inevitably unequal distribution of the weight of the train upon it, were such as to threaten the instant downfall of the whole structure. These dangerous undulations were most materially aggravated by the chain itself, for this obvious reason, —that the platform or roadway, which was constructed with ordinary trussing for the purpose of rendering it comparatively rigid, was suspended to the chain, which was perfectly flexible, all the parts of the latter being in equilibrium. The structure was, therefore, composed of two parts, the stability of one being totally incompatible with that of the other; for example, the moment an unequal distribution of weight upon the roadway took place by the passage of a train, the curve of the chain altered, one portion descending at the point immediately above the greatest weight, and consequently causing some other portion to ascend in a corresponding degree, which necessarily raised the platform with it, and augmented the undulation. So seriously was this defect found to operate, that immediate steps were taken to support the platform underneath by ordinary trussing: in short, by the erection of a complete wooden bridge, which took off a large proportion of the strain upon the chains. If the chains had been wholly removed, the substructure would have been more effective; but as they were allowed to remain, with the view of assisting, they still partook of these changes in the form of a curve, consequent upon the unequal distribution of the weight, and eventually destroyed all the connexions of the wooden framework underneath the platform, and even loosened and suspended many of the piles upon which the framework rested, and to which it was attached. The study of these and other circumstances connected with the Stockton

Bridge, lead me to reject all idea of deriving aid from chains employed in the ordinary manner. I have therefore turned my attention to other modes of employing them in conjunction with the wrought-iron tube, (as suggested by Mr. Hodgkinson,) if such should be found necessary upon further investigation. As I have already stated, in this I perceive no difficulty whatever; indeed, there is no other construction which has occurred to me which presents such facilities as the rectangular tube for such a combination. Having, I trust, clearly explained my views in reference to this important work, I have only to add, that in two months I expect every arrangement will be completed for commencing the masonry, which shall be conducted with the utmost activity and vigor. I can scarcely venture to say, until after these arrangements are finally completed, at what period we may calculate upon the completion of this bridge, but I cannot recommend you to calculate upon the whole being accomplished in less than two years and a half.

Lond. Railway Jour.

AMERICAN PATENTS.

List of American Patents which issued in the month of May, 1845. *With Remarks and Exemplifications, by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For improvements in the *Machine for planing, sawing, tongueing, grooving, and rebating boards;* Reid R. Throckmorton, Brooklyn, N. Y., May 1.

In this machine the planing or facing wheel is similar in principle to what is known as the Bramah Machine, and as it is simply used for facing or smoothing the surface of the board, a large circular veneering saw is first used to reduce the boards to the required thickness. The other features are fully pointed out in the following:—

Claim.—"What I claim therein as new, and desire to secure by letters patent, is,

"1st. The combination of the veneer saw with the planing wheel, for the purpose of reducing the plank or board to a uniform thickness:—and

"2nd. I also claim the combination of the veneer saw for reducing the plank or board to a uniform thickness with the tongueing and grooving wheels, as herein described.

"3rd. I also claim the manner of forming the tongue by the two tongueing wheels—having pointed cutter irons with two cutting edges, the one cutting the side of the tongue, and the other the shoulder of the same; the shafts of the said wheels standing at an angle of forty-five degrees, more or less, and crossing each other at or about a right angle.

"4th. I also claim, in combination with the tongueing wheels, the separate wheel for rounding the tongue.

"5th. I also claim the use of one of the tongueing wheels (the

other being removed) for cutting a rebate upon the edge of the plank where they are intended for over-lapping each other, as in weather-boarding.

"6th. I also claim, in combination with the planing, tongueing, and grooveing wheels, the wheel for forming a bead upon the edge of the boards.

"7th. I also claim the stationary knives for cutting off the stub-shot from the end of the plank, in combination with the feed rollers.

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2. For an *Improved method of shutting out the Miller or Bee Moth from the bee hive or palace;* George Upham, Hebron, Licking county, Ohio, May 1.

The patentee says:—"The nature of my invention consists in providing means of shutting out from the hive or bee palace the miller or bee moth at night, and of opening it in the morning, (that the bees may resume their labor,) by connecting with the bee hive or palace the roost of chickens or other fowls, (or, in other words, the *coop* of chickens or other fowls,) so as to convert the *roost* (whether it be a pole, a rope, or any other thing upon which fowls roost,) into a lever or pulley, either by hanging it, or by placing it upon a fulcrum, or in any other manner by which it can be used as a lever or pulley, or be made the means of shutting or opening the bee hive or palace—without that close attention which would be required of individuals shutting and opening the same at a proper time."

Claim—"What I claim as my invention, and desire to secure by letters patent, is the connexion of the roost, whether of chickens or other fowls, with the bee hive or palace. The use of the roost as a lever or instrument, by which the passage or passages of the bees (into and out of their hives) are shut at night, and opened in the morning—or any other manner of using the roost of fowls, whether the roost is a pole or any other thing."

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3. For an improvement in *Piano Fortes;* Charles F. Oliver and George W. Jackson, Lynn, Essex county, Massachusetts, May 1.

This improvement is for the employment of a supplementary string or strings, struck by the same hammer as the usual string, so that by the use of a damper, the supplementary strings, which are tuned an octave higher, may be sounded or not, at pleasure.

Claim.—"Having thus set forth our invention, we shall claim one or more supplementary strings, damper, and bridge, (or other analagous contrivance for supporting the strings and checking their vibrations, as above set forth,) in combination with the string or strings, and hammer beneath the same, the supplementary string being arranged, tuned, and operating with respect to the strings of a note, and struck by the same hammer, substantially in the manner above specified. We also claim the making the pad of the hammer-head of different degrees of elasticity, or harder in that part of it directly beneath, and which acts upon the supplementary string, than it is in the part or parts beneath, and which strike the other strings, the same being for the purpose above explained.

4. For improvements in the *Dredging Machine for excavating rivers, &c.;* Oliver Allen, Norwich, New London county, Connecticut, May 1.

The scoop is operated by a crane which turns on the axis of a capstan, and the mast of the crane, over which passes the rope to draw back the scoop, instead of being at the centre of motion of the crane, is at that part of the crane which rests and travels around on a circular platform. The scoop is drawn through the mud, &c., by means of a rope which passes over a pully at the forward end of the crane, thence over another pully at the back end of the crane, (which is carried back of the capstan to balance in part the forward part,) and then to the capstan.

Claim.—"Having thus described my invention, I shall claim my improvement in dredging machinery, the same consisting in the arrangement of the mast directly upon, and so as to be supported by the movable crane, in such manner as to be moved by, and with the crane, whenever the latter is turned horizontally towards the right or left, instead of making the said mast a fixture to the deck of the vessel or dredge, as heretofore.

"I claim the above described peculiar arrangement, with respect to each other, of the capstan and crane; and, in combination therewith, that of the chain which elevates the excavating bucket, the latter differing from other arrangements thereof, in being carried through the rear or after end of the crane, in the manner and for the purpose as herein before specified."

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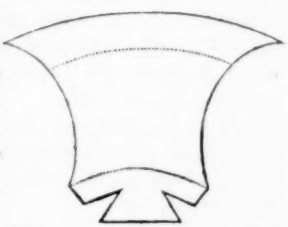
5. For an improved *Method of making Cloth Hats;* Jacob L. Chapman, New York City, New York, May 1.

This is for so cutting the cloth of which hats are made, as to give the form desired, preparatory to blocking, by sewing together two pieces, instead of making the top, crown, and brim each of a separate piece, as heretofore practiced. The form of each half is represented in the accompanying sketch:—



Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of constructing the hat bodies entire, brim, body, and crown, of two pieces of cloth or other material, cut in the form, and united in the manner herein represented, for the purpose of making a stronger hat than is made in the usual manner of forming the crown, brim, and body of a hat of separate pieces—and likewise for economising labor and material.

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6. For improvements in the *Machine for heckling and scutching Hemp;* George W. Billings and John Harrison, Glasgow, Howard county, Maryland, May 1.

Claim.—"Having thus fully described the construction and opera-

tion of our improved combined scutching and heckling machine for hemp or flax, what we claim as new therein, and desire to secure by letters patent, is the form and arrangement of the rest and the standards, as herein described and set forth.

"We also claim the rack in combination with the improved combined scutcher and heckle, for separating the tow from the shives and dirt, as herein described. We also claim the drums at each end of the combined revolving scutcher and heckle, in combination with the rings for preventing the hemp or flax from being drawn in at the ends and around the journals or shaft of the same, as herein described. We are aware that machines for beating, scutching, and cleaning hemp and flax, have been made with rows of teeth on a cylinder, and therefore we wish it to be understood, that we do not claim this as our invention; but what we do claim, and desire to secure by letters patent, is the placing of the teeth, which are in rows parallel with the shaft, in the direction of a helix diverging from the middle, of the length of the cylinder, towards each end, for the purpose of spreading and acting upon every part of a bunch of hemp, as described."

The rest, covered by the first claim, is elevated above two standards, and is otherwise detached from the frame, so as to admit of the introduction of the hemp on either side. The rack, covered by the second claim, is composed of a series of sharp teeth, for the purpose of combing the wood and tow from the fibres. The drums are circular bands on the ends of the heckler or scutcher, which extend over rings projecting from the frame and covering the journals.

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7. For improvements in the *Machine for picking, ginning, and carding Wool, Hemp, Cotton, &c.;* Stephen R. Parkhurst, New York City, New York, May 1.

Claim.—"What I claim as my invention in the described machine, is arranging the metallic rings, composing the burring cylinder, so near together, that no burs or seeds, &c., can fall in between them, the rings having hooked teeth cut in the periphery, as described, and so placed around the cylinder as not to have the teeth on any two adjoining rings to come opposite each other, by which the wool or cotton is drawn in below the surface of the rings, and the seeds or burs are cleaned off.

"Secondly, I claim the combination of the burring cylinder, constructed as above described, with the feeding cylinders, and trash cylinder to separate the fibres of cotton or wool from foreign or useless substances."

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8. For improvements in the *Machine for cutting and crushing Corn and Cobs;* Hiram A. Pitts, Winthrop, Kennebec county, Maine, May 1.

Claim.—"Having thus fully described the nature of my improved machine for cutting up and crushing the ears of corn, and shown the manner in which the same operates, what I claim therein as new,

and desire to secure by letters patent, is the combination of the drum and cutter (F,) the cutter (G) on the case, and the regulating concave (H,) so as to co-operate in producing the desired effect in the manner set forth.

"I likewise claim the combination of the drum and cutter (F,) and the cutter (G,) on the case, arranged as above set forth, when used without the adjustable concave."

The cutters F are long knives extending from end to end of a drum, and attached to it tangentially, so as to cut against a permanent cutter, G, attached to the case, and thus sever the ears of corn, the pieces then being reduced by teeth on an adjustable concave H, there being teeth on the drum between the knives F.

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9. For improvements in the *Cylinder Printing Press;* Richard M. Hoe, New York City, N. Y. May 1.

The Patentee says—"The first improvement consists in the manner in which I have combined the flying sheet frisket for delivering the printed sheets on to a table, and in the arrangement of the parts connected therewith, by which the cylinder press is adapted to the employment of such a frisket for depositing the sheets. My second improvement consists in the manner in which I have arranged a simple lever and a cam plate for operating the grippers or fingers that lay hold on the sheet. My third improvement is in the manner by which the cylinder is raised from the form, when, from any cause, it is desired that an impression should not be taken. My fourth, and last improvement is in the manner of combining and arranging a series of springs for arresting the momentum of the bed of the press.

Claim—"What I claim as new therein, and desire to secure by letters patent, is first, the manner in which I have combined the flying sheet frisket with the cylinder printing press, as set forth. I do not claim this frisket as being new in itself, it having been applied to the bed and platen press, but never, as I verily believe, so modified as to adapt it to the cylinder press. I claim therefore the manner described of passing the ends of the slats between the adjustable tape rollers, by which they are enabled to conduct the sheet on to the frisket in the position which it must assume in the cylinder press, said frisket being governed in its motion by a cam arranged and operating substantially as herein made known.

I claim the lifting of the cylinder when it is desired that it should not bear on the form as it revolves, such lifting being effected by means of the apparatus connected with the lever, arranged and operating substantially as described.

I claim the manner herein made known of constructing the spring box or apparatus used by me for checking the momentum of the bed in a cylinder press, but which may be advantageously applied in other machines for a like purpose, said spring box or apparatus being furnished with a centre shaft carrying a toothed wheel that gears into wheels or pinions on several surrounding shafts, the whole of which shafts carry spiral springs arranged and combined as herein made known, so as to co-operate with each other, in the manner described."

10. For an improvement in the *Pump;* Frederick Walther, Winchester, Frederick county, Va. May 1.

In this pump there are two pistons attached to one piston rod (one at each end of the rod) working within one cylinder, the piston rod being operated by a cross head attached to the middle of the rod and passing out through slots in the cylinder and between the two pistons to receive the connecting rods.

Claim—"I would observe that I do not claim the pump action, nor the working of two pumps together by one piston rod, but what I do claim as new, and desire to secure by letters patent, is the working of two pumps upon one rod within one cylinder in the manner set forth —the cross piece attached to the piston rod, and passing out through the slots in the cylinder, in the manner and for the purpose herein described."

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11. For a *machine for filling Brush Blocks with bristles,* Samuel Taylor of Cambridge, and Abbot R. Davis of Boston, Mass. May 1.

The bristles are laid in a hopper and over a hole at the bottom thereof, from which a tube extends to the brush block placed below. A gauge punch, attached to a vertically sliding rod, moves up and down in this tube and (the end being forked) at every downward movement it carries a given quantity of bristles through the tube into one of the holes in the block, and in moving up to take another charge the bristles are prevented from being forced down by means of weighted cords passing over them on each side of the gauge punch.

Claim—"Having thus described our inventions we shall claim, the combination of the gauge punch with a hopper, arranged beneath it, and having a guide tube or other suitable contrivance of like character, adapted to it, the whole being arranged and operated substantially as above described.

Also, the manner in which the bristles are fed beneath the gauge punch, as fast as is necessary, when others are removed by the same from the hopper, viz: by means of the weighted strings, adapted to the hopper and frame of the machine, as above specified.

We also claim in combination with the weighted strings, elevating the hopper when the gauge punch rises upwards; the same being for the purpose of drawing the strings over the bristles, and thereby ensuring their movement beneath, and into the fork of the gauge punch.

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12. For an improvement in *Cut-off Valves for steam engines;* Thos. Rodgers, Paterson, Passaic county, N. J., May 1.

This is for an improvement on the cut-off-valves, patented by Horatio Allen, of New York in Aug. 1841, and noticed in this Journal vol. iv. third series, page 275, to which the reader is referred. The object of the present improvement is to shift the cut-off during the action of the engine by an arrangement of levers. One of the slide valves is operated by a hollow rod, through which passes the rod of the other valve, so that one can slide on the other, and these

rods are connected by means of two connecting rods with two arms of a lever (designated in the claim by the letters L. *m*, *n*,) the centre of which has its bearings in a lever A, operated by the piston rod, and the lever L, by a rod E, connects with an index and shifting lever. By this arrangement the two valves are operated by the lever A, and as the two slides are connected with it by the lever L, their relative position can be shifted at pleasure during the action of the engine, and thus regulate the extent of the cut-off.

Claim—"What I claim is the combination herein described of the three levers L, *m*, and *n*, having a common centre in the lever A, with the rod E, and the slide as a means of adjusting the slides while the engine is in motion, and the lever A is working the slides by a reciprocating motion, or any combination substantially the same; but I do not claim the combination of, or the right to use the combination of adjustable slides and fixed seats with openings for each end of the cylinder as herein referred to and set forth in letters patent granted to Horatio Allen in August, 1841.

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13. For a *Steam Car to run on Prairies;* James Semple, Alton, Madison county, Ill., May 1.

The following extract will enable the reader to understand the design and purpose of the inventor—viz:

"The driving wheels (says the Patentee) I construct in the following manner, viz: they are hollow cylinders of iron or wood, six feet in diameter, and five feet tread, more or less, closed at the ends. The object in making them so wide is to prevent their sinking into the soft earth, and they are made hollow and closed at the ends to give them greater lightness and buoyancy, and to prevent mud, water, or other material from getting into them. They may be made rough on the outside surface to give them greater adhesion. The guiding wheels are on a separate frame which turns on a pivot and slides under the main frame. They are made like the driving wheels and always on separate axles, and are five feet in diameter with four and a half tread, more or less. The size will be as much less in diameter than the driving wheels, as will make the lower part of the wheels on a level with the driving wheels, when the centre is placed below the guiding frame, and the tread will be sufficiently narrow to allow the wheel to play within the large frame while turning a curve, say on a radius of 400 feet. The guiding frame is turned in the same manner that steam coaches are turned on common roads.

"The power is applied by any of the ordinary modes.

"This description applies to the locomotive. The freight and passenger cars will be made with the same kind of wheels, four or eight in number, each wheel on a separate axle, and the forward wheels are affixed to a movable frame work like the guiding wheels of the locomotive. The locomotive and cars are attached together in any of the ordinary modes.

"The power or manner of applying the same for propelling this car is not claimed as a new invention; this may be done in any of the

various ways already known. I am aware that the tread of wheels for carriages has been made of sufficient width to prevent the cutting up of roads by the weight of common wagons, gun carriages, &c., drawn by horses; and that the extra width has been given to the treads of wheels for steam carriages on McAdamized and other roads, with the view of obtaining sufficient adhesion or resistance to the wheels, which being turned by steam power are termed driving wheels; but I am not aware that it has ever been suggested to make the treads of the wheels of steam carriages of sufficient width to sustain the weight on prairies in their various conditions, and on soft roads when such wheels are to be driven by steam power; and therefore what I claim as my invention, and desire to secure by letters patent, is the combination of the broad, high cylindrical wheels turning on separate axles, spreading out the surface or bearing so as to prevent sinking into the ground with a locomotive steam engine or other driving power, located on the carriage as herein described."

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14. For an *Improved Method of forming permanent Foundations under Water;* J. W. P. Lewis, Boston, Mass. May 1.

This is for making iron foundations under water in connexion with the iron screw pile; but we are under the necessity of omitting the claim, as it refers to and is wholly dependant on the drawings.

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15. For an improvement in the *Stove for heating Buildings;* Samuel Utter, New York City, N. Y., May 7.

Claim.—"I do hereby declare that I do not claim as new the causing of the draught to descend through the fuel, this having been done before, though under an arrangement and combination of parts essentially different from that devised by me, and herein described; but what I do claim as new, and desire to secure by letters patent, is the manner in which I have combined and arranged the respective parts of my stove, so as to allow the burning coal to rest on the solid stove bottom, without a grate, the lateral opening for the escape draught being entirely above the bottom of the stove, and leading thence into the air-heating chamber, by which device the radiation is increased, and the air for the supporting of combustion is also heated on its passage to the fire; the whole combination and arrangement being substantially the same as that herein described."

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16. For an improvement in the *Stove for heating Buildings;* Francis L. Hedenberg, New York City, N. Y., May 7.

Claim.—"What I claim therein as new, and desire to secure by letters patent, is the particular manner as above set forth, in which I arrange and combine the flue and air-heating spaces, and the pedestal of my stove, the hot air space being between the ascending and descending draught, the descending draught spreading around the base of the stove."

17. For a *Machine for raising the Nap or Pile on Hats;* John London and Thomas Shaw, New York, May 7.

The hat is placed on a block at the top of a vertical arbor, by which the hat receives a very quick rotary motion; a horizontal brush is applied to the top, and a flexible brush to the crown and brim, there being an arrangement of levers and weights to apply the necessary pressure, and to insure the bearing of the brushes equally on every part of the surface of the hat.

We are under the necessity of omitting the claim, as it refers to and is dependant on the drawings; but it is limited to the combination of the mechanism pointed out.

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18. For an improvement in the *Machine for Breaking and Cleaning Flax and Hemp;* Wm. Y. Singleton, Springfield, Sangamore County, Ill., May 7.

Two sets of rotating beaters are employed, consisting of arms projecting from the ends of two shafts, the arms of one interlocking the arms of the other, and the arms on each shaft are armed one half with swards and the other half with bars having projecting pins, the swards and bars alternating.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the making of the revolving skeleton cylinder, with combined swards and bars of teeth for the purpose set forth."

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19. For an *Improved Process for Curing and Preserving Meat;* George A. Scherpf, New York City, N. Y., May 7.

Claim.—"I do not claim as my invention the impregnation of meat by hydraulic or other pressure, nor do I claim the modes of producing desiccation; but what I do claim, is the process substantially as described, of curing meat by combining the operations of impregnation and desiccation in the manner set forth."

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20. For an improvement in the *Machine for Sowing Grain, Plaster, &c.;* Pierpont Seymour, East Bloomfield, Ontario County, N. Y., May 7.

At the bottom of a long hopper there is a rod which is notched or toothed to suit the kind of grain, &c., and above this there is another bar called the stirring rod, provided with small pieces of metal that extend down nearly to the bottom to stir the grain, &c.; and in connexion with these there is a gauge rod which regulates the discharge of seeds.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner in which I have combined the stirring rod or bar with the dropping bar or vibrating rod, and in combination therewith, the gauge rod with its index for regulating the amount of seed to be dropped in the manner above described."

21. For improvements in the *Machine for Stretching and Stuffing Horse Collars;* Wade Haworth, Dayton, Montgomery County, Ohio, May 7.

The patentee says:—"The nature of my invention consists of a frame on which the leather is stretched to be stuffed after it has been made into a collar, and in forming said collar when stuffed."

We are under the necessity of omitting the claim from its dependance on the drawings.

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22. For improvements in *Machinery for Crimping Leather for Boots;* Reuben and Starr Fairchild, Trumbull, Fairfield County, Conn., May 10.

The patentees say:—"The nature of our invention consists in an apparatus jointed at or near the centre, so that the leather to be crimped can be stretched thereon, and then bent into form, which we consider our first operation: the other parts consist of a form, with a guard or follower over the instep, with or without a groove cut on it to fit the inner edge of any common boot crimp, which prevents the leather from wrinkling and forming an uneven surface in crimping and making a more durable crimp. These are placed together forming a gate, and forced through between two check pieces, which stretch it into form, where it is held by the arrangement and combination of hooks therewith, without nailing, as hereinafter described."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is constructing the former in strips with a series of joints at or near the centre.

"We also claim the combination of a guard with the form over which the leather is to be crimped, the leather being placed between them to prevent the wrinkles, &c. as herein described.

"We also claim the hooks in combination with the crimp, so as to be brought over the back of the former and pass through between the jaws, and taken out on the under side as set forth, or they may be used in drawing up the leather and tack, &c.

"We also claim in combination with the above named guard and form, the bar in which are the screws, with a crank for drawing up the leather in the manner and for the purpose before specified."

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23. For a *Machine for Knitting Net Work for Fishing Seines:* John D. Cornelius and James Mott, Sr., Westburg, Queens County, N. Y., May 10.

This machine is necessarily very complex, and could not be understood without drawings, the publication of which would carry us beyond the limits of this work. The claims will, however, enable those who are versed in the method of knitting seines, to form a general notion of the principle of the invention.

Claim.—"We claim, *first*, the manner of forming the knots, by turning over the loops or meshes already made in the form of a noose, across the whole net at once, as herein set forth, by means of a knot frame constructed and operating substantially as described.

"*Secondly*,—We claim the manner of introducing the twine through the apertures of the noose formed by the knot frame, by means of a needle, substantially the same as set forth in the description in combination with the netting machine before described.

"*Thirdly*,—We claim the manner of casting off the knots from the knot frame, and of tightening them by means of the action of the swivel and bearing against the ends of the jacks, whilst the web of the previously formed net passes over the roller and is held firmly in its position.

"*Fourthly*,—We claim the manner herein set forth of combining the parts constituting the knot frame, consisting principally of the table, the counter table, three pairs of jaws attached to the table and counter table, each of which pairs of jaws is composed of two slips or pieces of metal, which are made to slide upon each other, so as to open and close said jaws; the arrangement and combination of the plungers and of the connecting rods, by which said plungers and jaws are actuated, being substantially such as herein described and represented.

"*Fifthly*,—We claim the manner in which we have combined and arranged the jacks and the slue wheel, with its carriage, and their appendages; by which combination and arrangement the jacks are made to rise successively, and to draw the twine up so as to constitute a loop; the slue wheel being divided into four, or any preferred number of parts, and being moved on with the carriage, and actuated by a rack and pinion substantially in the manner and for the purpose herein set forth.

"*Sixthly*,—We claim the manner of arranging as formed the twine comb, with its teeth or wires, to act against the rising meshes by the aid of the arm, acted upon by the pin, in the wheel of the counter table, or in any other way that is substantially the same.

"*Seventhly*,—We claim the manner of combining and arranging the mesh-frame, knot-frame, twine-comb, and their immediate appendages, so as to co-operate with each other substantially as herein set forth, and for the purpose herein mentioned."

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24. For an improvement in *Lamp Wicks;* Samuel Rust, New York City, N. Y., May 10.

The patentee says:—"This wick is peculiarly adapted for lamps, which raise or depress the wick by a roller. It consists of a narrow strip of tape about $\frac{3}{8}$ of an inch wide, or a narrow strip of muslin, canton flannel, or other suitable substance about $\frac{3}{4}$ of an inch wide, (more or less,) with the edges of the muslin or canton flannel turned and doubled over, so as to meet or nearly so, in the centre, which leaves the edges double, and prevents it from raveling, which I do with great facility by machinery. This muslin or canton flannel when doubled, forms a strip, of course, only half as wide, the same width as the tape, which does not require the edges to be doubled over. On to each edge of this strip the common candle wick is sewed, or otherwise attached. This wick is beautifully adapted for

my spring lamp, with a thumb-piece formerly patented by me, which has a flat tube.

Claim.—"What I claim and desire to secure by letters patent, is the *lamp wick* made or combined as above described, viz: with a strip of tape, muslin, canton flannel, a piece of twine, or any other substance, and the candle wick attached or combined to the sides as above set forth, or in any other way that is essentially the same, and for which I request letters patent.

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25. For a method of *Water Rotting Flax and Hemp;* George W. Billings and John Harrison, Glasgow, Howard County, Me., May 10.

The flax or hemp to be rotted is submersed in water kept at about 90° Fahrenheit's scale by artificial means, such as steam circulating through pipes in the bottom of the tanks.

Claim.—"Having thus fully described the construction of our improved rotting vat for hemp or flax, and the manner of regulating and diffusing the temperature equally through any portion of the contents of the same while the rotting process is in progress,—we would remark that we do not claim the rotting of hemp or flax by means of hot or warm water, as that has been done before; but what we do claim as new, and desire to secure by letters patent, is the performing the rotting process upon hemp or flax, by keeping it immersed in water at a uniform temperature by artificial means, and that temperature not to vary more than twenty or thirty degrees from ninety of Fahrenheit's thermometer."

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26. For an improvement in the *Machine for Chopping Meat;* Jas. M. Welder, Peterborough, Hillsborough County, N. H., May 10.

The meat is to be placed in a trough which has a reciprocating movement back and forth, that the meat may be acted upon by cutters or choppers attached to a vertically sliding gate.

The claim is limited to the combination of parts by which the hands that move the sliding-trough are shifted to reverse the movement. The claim is omitted as it refers to and is dependent on the drawings.

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27. For an improvement in the *Spike Machine;* John F. Winslow and Israel Blanchard, Troy, N. Y., May 10.

This is for the addition of an improvement to a spike machine patented on the 14th of March, 1834, to Osgood and Hunt, (see vol. XIV, page 244 of this Journal for a description of it,) by which the original machine is adapted to the making of hook-headed spikes. The griping dies are made with a projection which gives a slight bend to that part of the rod from which the head is to be formed, so that when the header is forced up it forces the metal in the knuckle of the head, to give the requisite strength.

Claim—"What we claim therefore as our invention and desire to secure by letters patent are the above described tools for forming hook-

headed spikes and their application to said Osgood & Hunt's spike machine, which tools are so formed that when introduced into the movable die box of said machine, a projection is given to the dies, so that that part of the rod of which the head is to be formed, receives the requisite bend in the operation of griping, as herein described, when the header described in Osgood & Hunt's specification of March 1834, advances and completes the head."

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28. For an improved *Air-tight Cooking Stove;* Henry N. Gros, Palatine Bridge, Montgomery county, N. Y., May 13.

Claim—"What I claim is the combination of flues passing down on each side nearly the whole width of the stove, and contracting under the bottom and on the opposite side as described."

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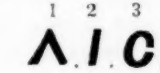
29. For an improved mode of *Stencil Painting and Printing;* Ezekiel B. Foster, Philadelphia, Pa., May 13.

The Patentee says—"The nature of my invention consists in forming all the letters of the alphabet in stencil painting and printing by means of nine characters, by changing, reversing, and combining said characters, thus making nine characters to answer the place of twenty seven letters in the operation of which the letters are made more perfect, leaving no spaces or interstices to be filled up after the brush has passed over the stencil, as in the present mode, or mode now in use."

Claim—"What I claim as my invention and desire to secure by letters patent is the mode of forming and printing the letters in stencil printing or painting by means of the combination of characters represented in the draft and numbered 1, 2, 3, 4, 5, 6, 7, 8, 9, essentially in the manner described, and the nine characters so represented."

It is not deemed necessary to explain the application of these characters; but the reader will readily understand by an inspection of the nine following figures, how these are to be applied to form letters.

1 2 3 4 5 6 7 8 9



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30. For an improvement in the *Spark Arrester;* Wm. C. Grimes Philadelphia, Pa., May 13.

Within the chimney there is an inverted, perforated, or wire gauze cone through the meshes of which the gaseous products of combustion are to escape, and the space between this cone and the chimney case is formed into a spiral flue, so that the draught in passing through forces the sparks, &c. by centrifugal force, into an outer receptacle.

Claim—"I do not claim the perforated cone, or the spiral thread, taken separately or individually as they have long been known, but the placing of a spiral thread within the chimney proper and combining it with, so as to form spiral flues around a perforated cone or

screen, I verily believe to be features of novelty, as they are of utility.

"What I claim as new, and as constituting my invention, and desire to secure by letters patent, is, the giving to the gaseous current a rotary motion around a central, conical, or other formed, screen, by means of a spiral thread or threads combined therewith, which traverse the chamber and form spiral flues around the same, whereby the sparks and the other solid particles floating on the gaseous current acquire a centrifugal force, that throws them off through proper openings into an exterior chamber, while the gases escape through the central screen, as herein before set forth."

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31. For a method of manufacturing *India Rubber Cloth and sheet India Rubber;* Nelson Goodyear, Newtown, Fairfield county, Ct., May 13.

The patentee says—"The design and purport of my invention is to impart additional strength, solidity, tenacity, and durability to all India rubber fabrics, by combining in any manner the shearings, clippings, or nappings of wool, cotton, silk, hair, fur, or any fibrous substance, with India rubber, or any compound of it."

Claim—"I claim as my invention the intermingling and combining fibrous substances with the gum in forming India rubber fabrics, solid and firm in the body, with a smooth surface, resembling leather."

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32. For an improvement in the *Spark Arrester;* Samuel Swett, Jr., New York City, N. Y., May 13.

The patentee says.—"This invention and improvement consists in surrounding the ordinary smoke pipe of the locomotive or other engine with an inverted funnel shaped case, leading into the bottom of a drum, whose ends are closed with reticulated wire for arresting the sparks, the sum of the areas of the meshes of which (through which the smoke passes) being equal to the area of the smoke pipe through which it passes from the fire box to the drum. The sparks, when thus arrested by the wire cloth fall down into a space between the smoke pipe and case, from whence they are removed through a door in the case—or the sparks may be conducted into a receiver containing water, or into the ash box, or into any convenient place."

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the combination of the drum and case with the smoke pipe, constructed and arranged and operating in the manner and for the purpose set forth, or other mode substantially the same for producing analogous results."

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33. For a *Self-operating Engine for Turning Wood, &c.;* Milton W. St. John, Plainfield, Otsego county, N. Y., May 13.

To the sliding frame that carries the cutters from end to end of the wood to be turned there is a wheel with holes of different sizes, through either of which the turned wood passes, and which, therefore,

answers the purpose of a rest. On one face of this wheel there is a metallic edge which cuts into the wood for the purpose of feeding or moving the carriage forward by the rotation of the wood, and which, by means of a wedge piece can be set to any desired inclination for the purpose of increasing or decreasing the feed.

On the same face of this wheel there is a cutter for reducing the wood to the required thickness, to admit of its passage through the hole in the guide wheel, and on the other, a movable cutter, which by means of a guide can be made to turn the wood to any desired form.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the manner of feeding by means of the inclined feeding wedge, as before set forth—whether the operation be effected precisely in the manner described, or in any other mode substantially the same.

I also claim the combination of the sizing gauge, with the wheel and adjustable cutter, for the purpose and in the manner described."

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34. For an improvement in the *Cotton Cleaner;* Jane A. Davis, administratrix of Henry G. Davis, Clark county, Ala., May 16.

Within a conical concave, the lower half of which is a grating, there is a conical runner with spiral wings and rows of pins projecting therefrom, to act on the cotton as it passes through the machine.

Claim—"Having thus fully described the improvement, what I claim therein as new, and desire to secure by letters patent, is the runner constructed as herein described, having spiral wings thereon, from which project rows of pins, substantially in the manner and for the purpose herein made known; and, in combination therewith, the grated concave as above set forth."

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35. For improvements in the *Horse Power;* Elihu H. Jaques, Springfield, Windsor County, Vt., May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is supporting the upper frame on, and attaching it to, the spindle, on which the master wheel turns, in combination with the mode of connecting the spindle with the lower frame, by means of a turning platform, the master wheel being situated between the two frames, and there being no other connexion between the two frames than the said spindle, whereby the upper frame which supports the belt wheels may be turned in any direction without moving the under frame as described. I also claim connecting together the inner ends of the levers by which the horses pull, by joint links—the said levers being jointed to the master wheel near its periphery, so that the horses shall perform their proportion of labor, as described."

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36. For an improvement in the *Truss for Hernia;* David B. W. Ward, Bethlehem, Litchfield County, Ct., May 16.

The pad of this truss is fixed to a plate connected with the bed

plate, by means of spiral springs, so as to yield to any undue pressure; but with the view to have a circle around the elastic pad which shall be more elastic; a circular plate attached to the bed plate has its edges turned in a regular curve, over the spring pad plate, thus having the spring pad movable within the unyielding circle.

Claim.—"I do not claim the manner of effecting the elasticity of my pad by means of spiral springs, as that has before been done; but what I do claim as my invention is combining with a pad so rendered elastic, the cushion and stuffing thereof, in such manner that the central portion of the pad shall present a hard surface, while the portion exterior to said centre shall be of a soft yielding nature, and at the same time exert a gentle pressure.

"And I further claim, in combination with the above pad and cushion, making the concavo-convex plate project beyond the edges of the plate, so as to effectually prevent the cover of the pad from coming between the two plates in the form and manner set forth."

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37. For an improvement in the *Common Bench Vice;* W. H. Taylor, Rochester, and A. P. Norton, Oneida, N. Y., May 16.

The movable is connected with the permanent jaw at top by means of the screw, and at bottom by means of a sliding rack, into the teeth of which a paul takes to hold the jaw at any desired distance. This paul is jointed and connected by means of a rod with the nuts, so that when the jaws gripe, the nut forces the paul into the teeth of the rack. To insure the parallelism of the jaws, jointed rods, similar to those known as parallel joint links, are employed.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the cross levers with the rack and paul, substantially as herein described: we do not wish to be understood as claiming this apparatus for a parallel motion, but in combination with the bench vice as described, we believe it to be new.

"We also claim the combination of the paul for holding the rack, with the nut on the screw of the vice, so that when the nut is pressed up in griping any thing between the jaws, the paul will act and brace the lower end of said jaws in proper position."

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38. For an improvement in the *Machine for Burring Wool;* Theodore Ely, New York City, N. Y., May 16.

This is for an improvement on a machine for this purpose, patented by the same person, on the 14th of September, 1843, which has not yet been reached in our list of arrears. The burring cylinder is armed with longitudinal metal plates, having sharp teeth projecting from one edge, which are tangential; below these plates there are radial grooves, in which bars slide by means of cam grooves on each side. The moment the teeth have been filled with wool or cotton, the bars are forced up against the under surface of the plates, and hold the fibres until the burs or seeds are removed, and then the bars are drawn back to liberate the fibres.

Claim.—"What I claim as my improvement, and desire to secure

by letters patent, is the combination of the movable bar with the stationary teeth on the main cylinder, substantially in the manner and for the purpose above described."

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39. For an improvement in the *Water Wheel;* J. J. Springsteen, Oswego, Tioga County, N. Y., May 16.

The patentee says:—"The nature of my invention consists in constructing a water wheel to be worked under pressure with movable buckets, which are suspended by their centres, and when closed are on a line with and form a part of the periphery of said wheel: when open they fill the space between the curb and wheel."

Claim.—"Having thus fully described my improvements, what I claim as new, and desire to secure by letters patent, is the combination of the movable balanced buckets, with a water wheel having recesses to receive the inner ends of said buckets in the manner and for the purpose above specified."

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40. For an improvement in *Water Wheels;* James Leffel, Springfield, Clark County, Ohio, May 21.

Instead of having the floats extend only to the bottom of the scroll penstock, as heretofore, they are extended up into it, for the purpose of being acted upon by the current of water therein.

Claim.—"Having thus fully described my invention in the bevel centrifugal water wheel, and shown the manner in which the same operates, what I claim therein as my invention, and desire to secure by letters patent, is the projecting of the beveled floats of the beveled centrifugal water wheel up into the funnel drift of the water in the scrolled penstock, combined and arranged as described in the specification."

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41. For improvements in machinery for *Crimping Leather for Boots;* Chevey Snow and Thomas N. Sadler, Spencer, Worcester County, Mass., May 21.

We are under the necessity of omitting the claim in this case, because of its dependance on the drawings, which are too complex to be inserted.

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42. For an improvement in the machine for *Breaking Coal;* Benj. Haywood, Pottsville, Pa., May 21.

This is for a modification of a machine previously patented by Jos. Battin of Philadelphia, Pa.

Claim.—"Having thus fully described the nature and operation of my improvement on the above named machine, for breaking anthracite or stone coal, what I claim therein as new, and desire to secure by letters patent, is the employment of pairs of rollers, to effect the breaking; one of which rollers, instead of being furnished with teeth, is perforated with holes, through which the broken coal is to pass, the other roller being provided with teeth, corresponding with and enter-

ing a short distance into the holes in the first named roller, in the manner and for the purpose set forth: said rollers being geared together, and otherwise operating in the same manner as the within named machine of Joseph Battin."

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43. For an improved method of *Clarifying, Graining and Draining Sugar;* John De Brettons, New Orleans, La., May 21.

The patentee says:—"In manufacturing sugar by my improved process, the cane juice from the mill is passed through a wire sifter into the clarifying pan, all of the usual construction: when in the clarifier a small quantity of the prepared lime or fining must be given and heat applied, in order to facilitate the heavy skimming to float on top. The liquor is then drawn into the precipitator, where it receives its full quantity of its preparation of fining. From the precipitation or precipitators the liquor is then drawn into the kettle, and goes through the same process of boiling as in the ordinary way. When the liquor comes to the battery kettle four or five minutes before striking, add four ounces of burnt alum, and one ounce of dragon's blood, combined with twelve grains of arsenic."

Claim.—"Having thus fully described my improvement, what I claim therein as my invention, and for which I desire to secure letters patent, is the method of using the rum as above specified in potting sugar—that is to say, by wetting each layer with the rum as it is potted. I also claim the conical perforated tubes inserted into the hogshead through which the molasses runs, which can be cleared by a stick or otherwise on the inside."

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44. For an improvement in the *Spring Door Lock and Latch:* Jacob Alricks, Wilmington, Del., May 24.

Instead of making the latch bolt to slide, it is made very short, one end being jointed to the inside of the forward end of the lock case, and the other jointed to a bridle which forms the connexion with the cams or levers of the knob spindle.

Claim.—"What I claim therein as new, and desire to secure by letters patent, is the manner herein described of arranging and combining the piece which forms the spring catch with the box of the lock, and with the stirrup by which it is forced forward, the said catch being attached to the box and to the stirrup by means of joint pins, so that its operation shall be substantially the same with that herein set forth."

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45. For improvements in the *Riding Saddle;* Robert Caldwell, Montevallo, Shelby County, Ala., May 24.

Claim.—"Having thus fully described the manner in which I construct my improved saddle, what I claim therein as new, and desire to secure by letters patent, is the converting the same into a spring saddle by means of a spring bar of steel bent into the form of the outer edge of a cantle, so that the straining girths may extend there-

from to the pommel, thereby giving elasticity to the seat as set forth. I likewise claim the manner of combining the stirrups with the saddle by allowing the stirrup straps to pass over staples or rods, which are free from the saddle at the rear ends; by which device the stirrups will be detached from the saddle in case of their being drawn back by the falling of the rider or otherwise.

"I do not claim the forming of such staples or rods as new in the abstract, but limit my claim to their employment as a means of connecting the stirrups with the saddle, by which an important improvement is effected."

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46. For an improvement in the *Ink Stand;* Walter Hunt, New York City, N. Y., May 29.

This is for the purpose of closing the aperture in which the pen is dipped by a self-closing cork or valve, which is effected by means of a float, the upper surface of which is covered with some elastic or yielding substance forced up against the inner end of the tube by its buoyancy in the ink.

Claim.—"What I claim as new, and my own invention in the within above described ink stand, is the introduction of a float with a soft, yielding or elastic upper surface, and so formed as to operate at all times either as a stopper to the ink tube, or a floating cover to and upon the surface of the ink in said stand, arranged substantially in the manner and for the purposes herein above set forth and described."

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47. For an improvement in the self-acting *Cheese Press;* Chester Stone and George S. Collins, Rootstown, Portage County, Ohio, May 29.

The frames of the bed and platen slide on each other, and are each suspended on the end of a separate lever; and these levers, when horizontal, are parallel and hung on fulcra at the middle of their length, their opposite ends being connected by a joint link. When the cheese is placed on the bed, its weight carries down that end of the lever on which it rests, and the two levers being linked together at the other end causes them to approach each other, and thus to make pressure on the cheese.

The claim is limited to the arrangement and combination of the parts to produce this end. We omit the claim, as it refers to the drawing.

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48. For an improvement in the combined *Cooking Range and Hot Air Stove;* Moses Pond, Boston, Mass., May 29.

Claim.—"I do not claim the introduction of the smoke, heat, or other volatile products of combustion, to the sides of an oven of a cooking range, through lateral flues proceeding from the boiling chambers: nor do I claim (as is claimed in certain letters patent numbered 3589, and dated May 17, 1844,) carrying the lateral flues

or those proceeding from the boiling chambers, directly against the front parts or halves of the oven, and thence vertically, and thence horizontally, over and in contact with the top thereof, and opening the same at the top of the oven into a discharge flue: in combination with carrying the main discharge flue of the fire-place beneath, and in contact with the underside of the oven, and around and in contact with the rear parts, or halves of its sides and top, (whereby the rear parts of the sides are heated by the central flue, or that proceeding from the grate and under the oven,) and thence into the chimney or discharge flue; nor do I claim (as in my letters patent, numbered 2990, and dated March 4, 1843,) causing the heat and smoke to circulate against the sides and bottom of an oven, by means of lateral flues proceeding from the boiling chambers, and entering the sides of a casing surrounding the oven, in combination with two horizontal and vertical partitions, arranged between the oven and its surrounding casing, by which the smoke and heat are caused to come in contact with the front part, or a portion only of each of the sides of the oven, and from thence to pass underneath the oven; but that which I do claim is the particular arrangement of flues on the sides of the oven, (that is to say, carrying the heat into the front of the lower part of a chamber on each side of the oven, and making it pass to the rear, by means of a horizontal plate, thence upwards and over the plate, and towards the front of the chamber, and thence through an opening into the smoke chamber on the top of the flue plate,) in combination with carrying the central flue of the fire-place directly under the bottom of the oven, upwards and around its rear ends, and over its top plate, and thence into the before mentioned chamber in the top of the flue plate, by which arrangement I equally or uniformly spread heat over the whole of the sides of the oven, by the action of the lateral flues alone, and independently of the central flue, and use the central flue for the purpose of heating the bottom, end, and top, of the oven only; by which improved arrangement of central and lateral flues I am enabled to gain certain very important advantages, in baking evenly and without burning the articles in the oven, as I can apply a current of smoke and heat, either to the whole exterior surface of the side of the oven, without making it pass against the top, rear end and bottom thereof, and into the chimney: or I can make it pass in contact both with the sides, bottom, end and top, and into the chimney when desirable.

"Also, I claim in combination with the above the making a narrow opening or communication between the side flues and central smoke flues at the top of the oven, for the purpose above set forth, the same being effected by extending the flanch plate down from the flue plate, and away from the oven, as above described."

Patent Re-issued in the month of May, 1845.

For an improvement in the *Plough;* Hiram Deats, Administrator of John Deats, Quagertown, N. J., May 16.

This patent was originally granted to John Deats, on the 28th of December, 1831, and noticed in this Journal, Vol. ix, page 399, to which the reader is referred for an explanation of the mode of construction.

Claim.—"Having thus given a full and exact description of the manner of constructing the plough invented by John Deats, and shown the operation thereof, what is claimed therein as constituting his improvements is, *first*, the manner in which the main land-side piece is combined with the mould-board by means of the piece (*h h*) cast on to the land side, and fitting into the recess prepared for it on the front edge of the mould board, the two parts being drawn together by means of a wedge entering the space (*k*) as set forth. *Secondly*, the manner herein set forth of forming and combining the bottom land-side piece, (*e e*,) by which form and combination this piece is rendered reversible and capable of regulating the pitch of the plough as set forth. *Thirdly*, the manner of forming and combining the reversible cutter (*b*,) extending from front to rear of the upper part of the land-side, so as to constitute a part thereof, and being capable of being set forward to any required extent, from the manner in which it is connected to the main land-side piece. *Fourthly*, the manner of confining the combined share and point in place by means of the bolt (*f f*) passing up through the sheath, the bolt (*s*,) and the recess and tongue (*t v.*) *Fifthly*, the particular manner of combining the clevis with the piece (*x*) let into the end of the beam, so as to operate in the manner described."

List of American Patents which issued in the month of February, 1842,—*with Remarks and Exemplifications, by* CHARLES M. KELLER, *late Examiner of Patents in the United States Patent Office.*

1. For improvements in *Pumps;* Augustus Thayer, Chatham, Columbia County, N. Y., February 1.

The piston of this pump is composed of two cones, one screwing on to the barrel of the other, with the packing interposed between the two so that by screwing them up towards each other the packing is forced out—the water way through the piston and the valve seat being made within the upper cone. For the purpose of preventing the water from freezing in the pump above the piston, there is a discharge aperture in the body of the pump, governed by a valve which is opened by a projection from the pump rod, and to prevent this from operating when the weather is warm, a set screw is employed, against which the pump handle strikes to prevent the opening of the

valve. The body of the pump, which is to be of wood, is made in parts connected together by a double conical nut, into which the two ends to be connected are screwed.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is first, the construction of the piston with two hollow cones having a water way and valve in their centre connected by means of a male and female screw, cut upon said cones, in combination with the expanding wedges or packing—the whole being constructed and operating as set forth.

"Second, the mode of letting off the water in the upper part of the pump by means of the right angled valve arranged and operated in the manner before described.

"Third, the mode of connecting the logs by means of the double tapered screw-ring as described.

"Fourth, the arrangement of the adjustable screw for preventing the cog of the piston rod acting on the safety-valve when not required to be operated as described.

"Fifth, the method of connecting the lever and piston rod for increasing or diminishing the leverage and descent of the piston without increasing its ascent as described."

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2. For improvements in the *Printing Press for Printing Cards, &c.;* Wm. W. Smith, N. Y., February 1.

Claim.—"Having thus fully described the nature and operation of my press for printing cards, labels and other similar articles, what I claim therein as new, and desire to secure by letters patent, is the manner in which I have combined the apparatus for working the inking rollers with that for giving the impression, the two co-operating by the particular arrangement of the respective parts—that is to say, by placing the cone by which the inking rollers are operated on the end of the shaft on which the eccentric is placed by which the bed plate is forced forward so as to make pull—the whole being constructed and operating substantially as herein set forth. I do not claim the operating of the inking rollers by means of a cone and levers, but limit my claim, as above specified, to the particular arrangement by which the combined operations of the inking apparatus and that for taking the impression are effected as set forth.

"I also claim the particular manner of giving a longitudinal vibration to the distributing rollers by the combined operation of the spring, the cone or wheel, with its inclined face, and the friction roller, as described. I am aware that there is not any thing new in the giving an end play or lateral motion to the distributing roller—this having been before effected in various ways, and I therefore limit my claim to the special combination by which I effect this object."

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3. For an improvement in the *Plough for Ditching;* Herrick Aiken, Franklin, Merrimac County, N. H., February 1.

To the lower part of an appropriate frame is attached a horizontal cutter for the bottom of the ditch, and two inclined ones for the sides,

the three together giving the form to the ditch; and from the back of these cutters a long mould-board winds up to carry up and discharge the earth on the side of the ditch, and make an embankment.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the combination of the cutter with the winding trough for making ditches, whether made in the manner above described or in any other mode, substantially the same."

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4. For an improvement in *Fire-Arms;* Jesse Griswold, Chambers County, Ala., Feb. 1.

Claim.—"What I claim as my invention, and desire to secure by letters patent, in the within described combined guns or fire-arms, is the combining together in the same plane three or more barrels, or bodies of guns, whether large or small, in such manner that they may be fired simultaneously—the touch-holes of said barrels or bodies of guns being connected with each other by a tubular or channeled piece of metal, containing the priming powder, said piece of metal having a cover to protect the priming powder; and the whole being constructed substantially as herein set forth."

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5. For an improvement in *Floating Dry Docks;* Sela Hill, Jersey City, N. J., Feb. 1.

In this dock the cradle on which the vessel rests is composed of a series of truss frames, which slide vertically on piles, over which cords or chains pass, one end of these ropes or chains being attached to hollow cases or floats at the ends of the trusses, and the other provided with counter weights. All the hollow cases or floats on each side are connected together by a main pipe and branch pipes governed by valves to regulate the discharge of water, and thereby balance the dock.

The keel blocks slide towards, or from, the keel of the vessel on inclined planes, so that they can be adapted to the inequalities of the vessel's bottom.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of raising and balancing the dock by means of the air tanks, in combination with the moving piles, cords or chains and weights, in connexion with the lower tanks and their apparatus, as above described: also, the manner of using the keel blocks on inclined planes running parallel with the length of the dock, so as to fit accidental or other irregularities in the line of the lower surface of the keel of a vessel, as above described; and also the method of distributing the water into any of the sections of the upper tanks by shutes, valves and rods, as above described."

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6. For improvements in the manufacture of *Wrought Metal Cannon;* Ransom Cook, Saratoga Springs, N. Y., Feb. 1.

This is for making cannon by coiling the bar of iron in a helix on an arbor, by attaching one end to a collar on the end of the arbor, by

the turning of which, and the application of a roller, the bar is coiled in a helix: it is then heated to a welding heat, and, by the application of pressure, welded.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is—

"1st, the combination of the rod or arbor, collar and roller, for bending the bars composing the cannon, as described.

"2nd, the combination of the nut and screw with the sliding frame for compressing the coils, hoops, rings or bands, together against the collar in the operation of welding, as described.

"3rd, the mode of preparing the bars of which the cannon is to be composed, by welding plates together with the fibres or grain crossing, as herein described; and also welding plates of steel on the surface of the bars, which will compose the inner surface of the cannon for the purpose and in the manner described."

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7. For an improvement in the mode of *Hanging and Straining Mill Saws:* R. Cook and L. E. Burnham, Saratoga Springs, N. Y., Feb. 1.

The ends of the saw are provided with flanches, and the stirrups are screw rods in front and back, with their lower ends jointed to plates that pass within the flanches on the saw, so that the saw can be strained either at the back or the front edge, at pleasure.

Claim.—"What we claim as our invention, and which we desire to secure by letters patent, is the combination of the jointed plates and stirrups for straining the saw at the front and back edge, as described."

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8. For improvements in the *Press for Pressing Cotton;* Wm. C. Van Hoesen, Catskill, Greene County, N. Y., Feb. 1.

The follower of this press is forced upwards by means of two arms jointed to it, and having rollers at their lower end running on rails, so that when these are drawn together by ropes passing from each over a windlass between them they act as a toggle joint lever to force the follower up. On the shaft of the windlass there is a scroll wheel, around which a rope passes to turn back the windlass and permit the arms or levers to run out and draw down the follower.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the before described mode of applying power (accumulative) to the purpose of pressing substances by means of the before described combination of the wheel, the shaft, the ropes attached to the ends of the levers and the grooved wheels, and the iron rails upon which the said grooved wheels travel. Also, the spiral or scroll at the end of the shaft, in combination with the foregoing parts."

9. For an improvement in the method of *Raising Water;* Charles Joly, New York City, N. Y., Feb. 7.

The patentee says:—"The part of my machine which is to be used for the raising of water from a cistern, or reservoir, is a modification of the apparatus known under the name of the centrifugal pump, which I have so improved as to cause it to operate with less friction than under any of the modes of construction heretofore adopted."

Claim.—"Having thus fully described the nature of my invention, and shown the manner in which the same is to be carried into operation, I do hereby declare, that I do not claim the centrifugal pump as of my invention, this having been long known and used; but what I do claim is the particular manner of constructing the adjustable bearings or boxes for embracing and sustaining the shafts, such boxes or bearings consisting of the main box for receiving the sliding nuts, and the rotating cap with its inclined curves, arranged and operating as set forth."

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10. For a machine for *Working Butter, and Renovating the same;* E. Wilson and M. Lee, Redding, Fairfield County, Ct., Feb. 1.

This consists of a box which admits of turning upside down, with strainers on these two faces, so that the liquid worked out can be strained from one side and then the reverse; the butter is worked within this box by means of two fluted rollers.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the fluted rollers with the case having strainers affixed to it, and allowing the rotation of the case, all as herein set forth."

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11. For an improvement in the *Lard Lamp;* Zebulon Warrall, Chester Hill, Athens County, Ohio, Feb. 7.

Claim.—"I am aware that a fountain lamp for burning lard was patented some years since in England, in which the lard was kept in a melted state by means of a metallic rod heated by the blaze of the lamp—this I do not claim; but what I do claim as my invention, and desire to secure by letters patent, is the manner in which I arrange the wick, tubes and heaters, in combination with the movable fountain and dish, the heaters passing down through the wick tubes into the dish, and thence to the bottom of the reservoir—an arrangement of the heaters not before used in any fountain lamp for burning lard; and which, on account of its keeping the lard in the dish continually melted, renders this kind of lamp more available for burning concrete substances than heretofore."

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12. For an improvement in the *Ship's Windlass;* William Carr, Bath, Lincoln County, Me., Feb. 7.

The patentee says:—"The nature of my invention consists in the use of double knee levers attached to the brakes at one end, and ope-

rating by palls attached to the other upon ratchets affixed to the windlass."

Claim.—"I am aware that ships' windlasses have been operated with a lever working upon a fulcrum, and having a pall or hand on each side thereof, so as to actuate the windlass by the up-and-down motion of one end of the lever; and therefore I do not claim this as my invention; nor do I claim the mere application of the brake to a ship's windlass. What I do claim and desire to secure by letters patent, is the combination of the brake with the two knee levers and palls and ratchets, for the purpose and in the manner described."

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13. For improvements in the apparatus for *Drafting Boats*; Henry C. Brundage, Middletown, Orange County, N. Y., Feb. 7.

We are under the necessity of omitting the claim in this case, as it refers throughout to, and is dependant on, the drawings.

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14. For an improved *Screen for Screening Coal, Gravel, &c.*: Benjamin S. Hort, Kensington, Philadelphia County, Pa., Feb. 1.

Claim.—"What I claim therein as new, and desire to secure by letters patent, is the combination of a spiral thread of sheet metal, or other suitable substance, with such a screen, in the manner herein set forth, by which combination it is made to operate in a horizontal position, and the material to be screened is carried along the cylinder with a measured velocity, depending upon the closeness of the threads of the screw, and the rapidity with which said cylinder is turned."

(To be continued.)

MECHANICS, PHYSICS, AND CHEMISTRY.

Historical and Practical Account of the methods employed in the Manufacture of Filigrained or Filigree Glass, and of Flint and Crown Glass,—communicated by M. BONTEMS, ***Director of the Glass Works of Choisy-le-Roi, at a Special Meeting of the Société d'Encouragement, April 23,*** 1845.*

Filigrained or Filigree Glass.—You are aware, gentlemen, that filigrained glass is not a recent invention; it is often called Venitian glass, which points out its origin; but it is not generally known that the Venitians of the 15th, 16th and 17th centuries, who manufactured this very beautiful article, were not themselves the inventors of it: they only revived an art which had been practised in the most remote

* Throughout this paper the author has made use of the French measures, the equivalents of which are as follows, viz:

Centimetre = .39371 inch.
Millimetre = .03937 "

Gramme = 15.433 grains.
Kilogramme = 15433 grains, or 2.204 lbs. avoirdupois.

By the word "*crystal*" is meant *flint-glass*.

antiquity. Glass found in Egyptian tombs of authentic date, carries back this art many centuries before the Christian era. You know the fable related by Pliny respecting the origin of glass, which is absurd, and cannot have led to it, as a much stronger heat than that required for cooking was necessary to produce the fusion spoken of by him.

It is acknowledged that glass is as ancient as bricks and pottery; the operations necessary in the potteries, as well as those in the separation of metals from their ores, must certainly have produced glass, and the properties of this substance must have been immediately noticed. The first glass-makers lost no time in turning to advantage the property possessed by metallic oxides of coloring glass so as to imitate precious stones; and it may be said that the fragments of ancient glass serve in some degree as a guide to throw light on the practice of metallurgy among the ancients: in fact we see by these fragments that the ancients used as coloring substances, manganese, iron, copper, silver, antimony, cobalt, &c.; some specimens have evidently been opalised by means of arsenic.

The Egyptians and Phenicians appear to have been, for many ages, the only manufacturers of glass; the Greeks do not seem to have carried it on; and when the Romans had extended their conquests in all directions, the Egyptian and Phenician glass-makers brought their tribute to the unbridled luxury of these masters of the world; glass-makers came even to Italy to establish themselves, and it may be said that at this period were manufactured those specimens of glass which, as works of art, are the most valuable ever produced: I will mention, as examples, the *Portland vase* in the British Museum, and a vase of a similar description in the Museum of Naples. These vases, of a chaste form, were made of deep blue glass, covered with a thin coat of opaque white glass: the artist operated on this opaque coat as is done in executing cameos, and has represented mythological subjects in white bas-relief on a blue ground, with a delicacy, a perfection of execution, of which only *chefs-d'œuvre* of antiquity can give us an idea. In our days, gentlemen, coated glass is made; the material, I acknowledge, is often more beautiful, but the shape in general is faulty, and the coat (or layer) or exterior coats are cut out, and the drawing clumsily executed by our cutters or engravers, very unworthy successors of those artists whose master-pieces (*chefs-d'œuvre*) we admire.

The ancients, independently of single or coated glass, have left us specimens of their ability in the manufacture of filigree glass, and also of what I shall call *Mosaic* glass, which the Venitians and Germans call *millefiori*. They, moreover, made window glass. The Venitians made glass of all kinds; the reputation of their blown glass is still known: we will only speak of filigree glass, the manufacture of which will be explained to you, as far, at least, as it can be done without glass furnaces.

Filigrained or filigree glass is that in which very numerous threads of white opaque or colored glass are interlaced, assuming a multitude of different irregular forms; and here take notice, that I do

not speak of threads of white or colored *enamel;* I establish a marked distinction between the word *glass* and the word *enamel;* and, although, in reality, any enamel whatever may be nothing more than glass, I restrict the word *enamel* to the white or colored glass intended to be applied as a coat or layer, and to that which is used in painting. These white or colored glasses are ground and applied with the brush on pottery, on metal or on glass, and again melted under the muffle; it is to these kinds of glass that I give the name of *enamel;* but whenever a white or colored glass is made use of by the glass-maker in the glass-house fire, I make use of the word *glass.*

Filigrained glass is composed of a certain number of elements manufactured separately: thus every vase is formed of 25, 30 or more rods in juxtaposition, united by the heat of the furnace and afterwards blown as a single mass of glass. I will suppose these threaded rods prepared, (I will hereafter explain the mode of manufacturing them:) they are placed round the interior of a cylindrical mould of metal or of fire clay, and are fixed at the bottom of the mould by means of a thin layer of soft earth, in which their extremities are inserted; this mould is heated near the glass-house furnace, not to so great a degree as to soften the rods, but merely to render them susceptible of being touched by hot glass without becoming calcined; then with a blowing-iron a small quantity of glass or transparent crystal is taken from the glass pot and blown into what is called in the glass-houses a *paraison,** a little bulb or ball, that is to say, a preparatory piece, or the preparatory portion of a piece; there is blown, I say, a small cylindrical bulb of a diameter rather less than the space existing between the small rods in the mould; the bulb or ball (*paraison*) is heated to a high degree, and blown so as to press against the rods: they very soon adhere to the bulb or ball, so that in lifting up the blowing-iron and holding down the mould, the ball or bulb takes with it the little rods: the whole is re-heated so as to render the adhesion complete, and to soften the rods: it is then rolled on the marver, (a sloping iron table:) it is again re-heated, blown a little and cut off with the shears, a little above the bottom, so as to unite the rods in a central point: by this means is obtained a mass which is worked like a common (*paraison*) ball or bulb, and to which is given the desired form by the usual methods employed in blowing glass. By means of the operations of rolling on the marver and blowing, the rods become flattened both on the exterior and interior, which produces on the figures of the filigrees the effects which we shall notice in speaking in detail of the rods. If no movement of torsion has been given to the *paraison,* the figures remain longitudinal, and in the same plane as the axis of the piece; but if, after having made the rods adhere, a rotary movement on itself is given to the blowing iron, retaining at the same time the lower extremities of the rods with the nippers (*fers*) a torsion is produced that gives to the rods a spiral direction, which they retain when the piece is finished by the usual methods. It is more difficult to keep the rods in their primitive position, in the

* This is called by Mr. Parkes, in "Essay on Glass-making," a *parisienne.*

same plane as the axis of the piece; for you know that glass is worked, as it were, on the lathe; it is, therefore, necessary that the workman should have a very light hand, to avoid giving, when shaping his piece, a slight degree of torsion near the *pointil* or *punto*, and particularly at the widening of the piece.

After having shown the mode of manufacturing filigrained pieces when we have the rods which form their elements, I will now explain the processes by which these rods are produced. The basis of all is a simple thread enveloped in transparent glass: we will suppose, in the first place, that only white opaque threads are made use of, and, by the way, the most beautiful works of the Venitians contained little else besides threads of this color. Most certainly they were well acquainted with colored glasses, but they rarely employed them in works of this kind; they thought, very correctly, that the merit of these pieces consisted in their lightness, the distinctness of the threads, their grace and their form, and that the introduction of color was, most frequently, only an evidence of bad taste.

To make simple threads, the glass-maker prepares glass rendered white and opaque by means of tin or arsenic, (tin furnishes more delicate threads, whose fine lines are better defined and more correct than those produced by arsenic.) The glass-maker takes on the extremity of his working iron, in the glass pot, about 200 grammes of opaque glass, this he rolls on the marver so as to give him a cylinder of about 6 or 8 *centimetres* in length, and suffers it to cool a little: he then plunges this small cylinder into melted white transparent glass, so as to form a covering or coating of about 5 *millimetres* in thickness: he again rolls it on the marver so as to equalize the transparent glass round the opaque glass: then heating it strongly, and applying to the extremity opposite to that attached to the working iron, a *pointil* or *punto* to which some hot glass adheres, he draws out this little column as he would a tube, until it is reduced to the desired diameter, about from 4 to 6 *millimetres:* finally he divides it into pieces of equal length: he requires for his stock different lengths, according to the articles he wishes to manufacture; they are usually from 8 to 15 *centimetres.*

Besides these rods with simple threads, the glass-maker should provide himself with similar rods of transparent glass, and he is then in a condition to prepare all the complex rods.

First, to obtain rods with spiral approximated threads, which, by being flattened, produce a net-work with meshes of equal size, the glass-maker arranges in the interior of a mould of metal or fire-clay, similar to that already described, rods with simple threads, alternated with rods of transparent glass: he then takes up on the extremity of his working-iron some transparent glass, with which he forms a massive cylinder of a size suitable to enter into the mould which is lined with these little rods, and previously heated a little below a red heat. Then having strongly heated this cylinder, he introduces it into the mould, in which he works it so as to press the rods, which thus adhere to the transparent glass; he raises the working iron, at the same time holding down the mould, and thus draws out the rods with the

cylinder: he again heats the whole and rolls it on the marver, so as to make the adhesion more complete: after which, heating the extremity of the cylinder, he at once cuts this extremity with his nippers, he heats it afresh, seizes it with the nippers, and draws it out in length with his right hand, while with his left he causes the working iron to revolve rapidly on the glass-maker's chair (*bardelles*) of his work-bench. As the extremity of the column extends, the threads roll spirally round it: when the workman has drawn out, at the extremity, a rod of the desired dimensions, about 6 *millimetres* in diameter, and the threads have been sufficiently twisted, he cuts with the nippers, heats anew the extremity of the rod, and seizing and drawing it out, whilst he causes the working iron to revolve rapidly, he thus proceeds to produce another rod, and goes on in the same manner until the whole column has been drawn out.

Second, to make rods, which by being flattened produce threads disposed in fours, &c., (*quadrilles;*) there are placed in the mould, at the two extremities of a single diameter, three or four rods with simple threads, alternated with rods of transparent glass; the remaining portion of the interior of the mould is lined with transparent rods, in order to retain the threaded rods in their position, and the remainder of the process is the same as that for the rods already described.

Third, to obtain rods producing, by being flattened, the appearance of a string of beads, make a ball or bulb (*paraison*) the extremity of which, opposite the blowing-iron, is to be opened, so as to make a small, open cylinder; it is to be flattened, so as to admit rods only, and into this sheath introduce four, five or six rods, with simple threads, alternated with rods of transparent glass; heat and close the extremity opposite the blowing-iron, then the workman presses on the flat ball or bulb, (*paraison,*) whilst an assistant exhausts the air from the blowing-iron, so as to expel it from the ball or bulb (*paraison,*) and thus produce a solid piece in which the threads are enclosed. The workman places successively a small mass of hot transparent glass on each of the flat sides of his *paraison*, and rolls it on the marver, to render the mass cylindrical: he thus obtains a small column, in the interior of which the opaque threads are ranged across the centre: he then proceeds, as with the before mentioned rods, heating and drawing out the extremity, while he causes the working-iron to revolve rapidly on the glass-maker's chair, (*bardelles.*) By this movement of torsion, the line of threads is presented alternately in front and in profile, and produces the effect of a string of beads.

Fourth, it often happens that these beads are combined with threads disposed in fours, &c., by making use of a cylinder prepared for beads, for the purpose of introducing it into the mould prepared for threads disposed in fours, &c. The combinations, however, that have been pointed out, will put the workman in the way of introducing a great variety of others.

Fifth, sometimes a zigzag thread, usually colored, is introduced in the centre of one of the rods: for this, in the first place, a massive cylinder of transparent glass is prepared, of half the diameter of that

which is to be drawn out, on the side of which, and parallel to it, a small colored rod is caused to adhere; the whole is covered with another layer or coating of transparent glass, in order to produce a cylinder of the dimensions desired to enter into the mould for the threaded rods. The small colored column not being in the centre of the cylinder, will turn spirally round this centre by the movement of drawing out and torsion, and by flattening will produce a zigzag.

Among the Venitian specimens, and these perhaps are the most remarkable, there are some which present a net-work of simple threads, with meshes of the same size, each of which contains a bubble of air; this kind is the most difficult to produce. It may be effected, nevertheless, by blowing a first ball or bulb (*paraison*) with simple twisted threads, then a second ball or bulb (*paraison*) with simple threads twisted in a contrary direction; one of these balls or bulbs (*paraisons*) is to be opened, and the other to be introduced into it, so as to cause them to adhere together; these threads thus cross each other and produce meshes, which are similar to each other if the balls or bulbs (*paraisons,*) have been well prepared. If the opaque glass is hard, the fluting produced by the columns will still remain, to a certain extent, when the ball or bulb (*paraison*) is blown; as these flutings, which are twisted in an inverse direction, cross each other, when one of the bulbs is introduced into the other, a bubble of air will remain inclosed in each mesh when the two bulbs are united; the piece is finished in the usual manner, agreeably to the shape desired.

Independently of *filigree* glass, the Venitians made some attempts at what I have called Mosaic glass, better known under the name of *millefiori;* but in this respect they are far inferior to the ancients. The following is the manner of manufacturing it:

The elements, instead of being rods, are fragments or stumps of rods, whose section presents stars or other symmetrical forms composed of various colors: for instance,—the workman will form, at the end of his working-iron a small massive cylinder of red glass, round which he will apply five or six coats or layers of turquoise-blue glass, which he will so shape with his *procello* or nippers as to form prismatic triangular wings, whose base is upon the red cylinder: he then fills up the spaces between these wings with glass of another color, opaque-white or yellow; he rolls it on the marver and encloses the whole with a layer of a transparent color or light violet; he may then introduce this column into a mould lined inside with rods of another color or opaque-white, which by their section, will form a ring or circle of white beads; finally, when he has composed the column according to his wishes, he heats it strongly and draws it out to the thickness of from 10 to 15 *millimetres.* These first rods serve to line a mould into which is introduced a column formed of the same elements and a new combination of colors, and the whole is afterwards drawn out to the thickness of from 10 to 15 *millimetres.* The forms and colors of the sections may be infinitely varied. These small columns are then cut into pieces of about one *centimetre* in length, and with these pieces are prepared Mosaic pieces or *millefiori.* For this pur-

pose, the interior of a mould is lined with these pieces and heated to a dull red: a ball or bulb (*paraison*) is then blown, to which is given nearly the shape of the mould; it is heated and introduced into the mould, so as to cause the pieces to adhere to the ball or bulb; it is again heated, rolled on the marver, and the operation conducted as usual. A preferable method consists in making a ball or bulb, (*paraison,*) the bottom of which is drawn up inside towards the blowing-iron, so that this bulb, when detached from the blowing-iron, presents a circular opening composed of two concentric walls; it is suffered to cool: cuttings or fragments of rods are introduced, so as to fill up the space between these walls as completely as possible; this bulb is again heated gradually, a blowing-iron is prepared, the extremity of which is mounted with a disk of hot glass, so as not to intercept the hole through the iron; this disk is fitted to the upper edge of the bulb, and by this means the air contained between the fragments and the walls of the bulb is drawn out; finally, taking another blowing-iron prepared in the same manner, it is applied to the opposite side of the bulb, which is detached from the first blowing-iron; the interior of the bottom, drawn up as before mentioned, will then form the interior of the ball or bulb, which is to be blown with the second blowing-iron, and to which the desired shape is to be given by the usual means.

We have said that in the manufacture of filigree glass and *millefiori*, the balls or bulbs (*paraisons*) after having been brought to the proper point, were to be finished by the usual means; among these means we must not omit noticing a process which has been in use but five or six years, and adopted among us but for one or two years; I allude to moulding in wood. It is not that kind of moulding by which we obtain designs in relief on the exterior surface, but that which gives us the shape or form. Until lately, the profiles were given by means of the tools with iron blades and with wooden blades, with which the workman pressed the piece attached to the extremity of the blowing-iron, or of the pointil or punto which he caused to revolve on the glass-maker's chair (*bardelles:*) the exactness of the shape or form depended on the skill of the workman.

The glass-makers of Bohemia do not work in this way: among them the form of each piece, tumbler, decanter, vase, &c., is given by a mould of wood, made of two similar parts opening with hinges, and having interiorly the exact form of the article intended to be made; the workman makes his ball or bulb (*paraison,*) and when it is brought to the proper size and shape, he heats it strongly and introduces it into the mould: the boy in attendance closes the mould by means of its two handles, the workman blows, at the same time causing the blowing-iron to revolve on itself, in order that the lines of junction of the mould may leave no seams on the glass; a few instants after the boy opens the mould, and the workman withdraws the piece to which the shape has thus been given; it only then remains to attach it to the pointil or punto to finish its upper opening. The workmen of Bohemia do not take even this trouble; the mould gives the shape even to the furthest extremity; the piece is detached

from the blowing-iron when taken out of the mould, placed in the annealing arch, and after being taken from the arch, cut to the desired height by the cutter's wheel. Hence it is remarked that Bohemian glasses are cut on the edges, in place of being open, and, like ours, again rounded and smoothed by the fire. After the moulding of each piece, the mould is dipped into water to prevent its burning, and it may thus serve to mould forty or fifty pieces without having its diameters sensibly increased.

Such is the process which has been borrowed from the glass-makers of Bohemia, where it is as old as the glass-houses themselves of that country, which, however, are in many respects behind our own. By this process of moulding in wood, forms more pure and perfect are obtained than by the old methods: I express myself improperly in saying *more pure*, because, unfortunately, there are, in commerce, but few forms at all to be commended; there never was a time when industry more required the assistance of art; but I mean to say that we obtain pieces which are more regular, and exactly similar to the pattern; there are certain details even, which can only be obtained in this way and not by the old processes. This system of moulding was first introduced into the glass-works of Baccarat, where it has undergone many improvements; and this is not the only amelioration to which we are indebted to *M. Toussaint*, Director of this manufactory, ably seconded by *M. de Fontenay*.

[To be continued.]

The Committee on Publications cheerfully give place to the following communication, and it would gratify them to receive many more of a similar character,—as mechanics and others, by sending for publication the results of their own experience, even in matters apparently trivial, may often render an essential service to the arts.

COM. PUB.

Method of Preventing the rapid wear of Wire Sieves.

For the Journal of the Franklin Institute.

We wish to impart to Founders and others who make use of Wire Sieves the knowledge of a very simple but useful improvement, which may be applied almost instantly and without expense to any sieve, whether new or already in use.

It is well known to those who use such sieves that the vibrations of the web when in use soon cause it to crack off around the edges near the rim. In order to diminish the extent of these vibrations, and to aid the web in sustaining the weight that may rest upon it, the sieve-maker stretches two strong wires at right angles beneath the web, and in contact with it: these cross-wires arrest the vibrations of the web in one direction, but do not prevent them in the other when the sieve is inverted and rapped on the edge to cleanse the web and empty it of the coarser particles which the sieve has retained. And moreover, the lateral vibrations of the wires themselves upon the web soon wear the web through immediately over the wires, and thus cause a more speedy destruction of the sieve than

would result from the vibrations of the web unsupported by the cross-wires. Such might not be the case in sifting matter not gritty, but we have found it to be so in sifting moulding-sand; and accordingly, before the improvement about to be named occurred to us, we were in the practice of cutting out the cross-wires from every sieve before we put it in use.

The improvement referred to consists in interposing between the cross-wires and the web at its centre a common bottle-cork, placed endwise, and cut to such length as to press firmly upon the wires and the web, straining them asunder. To secure the cork permanently in its place, we make transverse groves across its lower end to embrace the cross-wires. This simple and cheap device is not only a complete remedy for all the evils mentioned above, but it will be found to be promotive of comfort and convenience in the operation of sifting.

BLAKE, BROTHERS.

New Haven, Feb. 13, 1846.

On the Use of Madder in Dyeing and Printing Calicoes, &c. By M. SASS.

(Translated from the "Bulletin de la Société d'Encouragement" for the London Journal.)

(Continued from page 202.)

There are seven principal points to be considered in the process of Maddering: 1st.—The quality of the water to be employed in dyeing. 2nd.—The quantity of water to be used with a given portion of madder. 3rd.—The degree of temperature most favorable to the operation. 4th.—The length of time necessary for the dyeing process. 5th.—The effect produced by lowering the temperature of the bath. 6th.—The quantity of madder necessary for the saturation of a given proportion of mordants. 7th.—The degree to which it is necessary to heat the dye-bath in order to extract the coloring matter.

1. The nature of the water to be employed for dyeing ought to be carefully studied, as it materially affects certain colors. Thus, for example, perfectly pure water, possessing no re-agent, is the best for all madder dyes, with respect to the brightness of the colors, except violet. Calcareous water, on the contrary, will not produce such fine reds and pinks as the pure water, the colors produced by the former being always more or less dull and tinged with violet; but it produces much better violets than the pure water. There are two kinds of calcareous water; the one holding sulphate of lime in solution, and the other charged with carbonate of lime; the former cannot be used, as it tarnishes the shades, and precipitates the bath of soap, which alone gives to the madder-dyed colors the required brightness; the latter can always he used, whatever may be the quantity of carbonate with which it is charged.

Water charged with metallic salts must not be used; ferruginous water, for instance, if employed, would decompose the soap-bath, tinge all the alumina mordants a violet hue, and stain the white parts of the fabric.

Sulphurous water is likely to injure and stain iron mordants, but will probably not act upon aluminous mordants, provided it does not contain any metallic salts in solution.

Experiments have been made to test the action of certain substances when added to the madder-bath, and the result produced has been unfavorable in all cases; perhaps these substances have been added in too great quantity in proportion to the madder employed. The experiments made were as follows:—A mixture of 31 grammes of nitric acid at 40° Beaumé, and a quart of cold water, was thrown upon 500 grammes of madder, the whole being well stirred. The next day 186 grammes of the mixture were diluted with 8 quarts of water; the specimen dyed (with all the precautions taken) was of a lighter red than another piece dyed with one third of that weight (viz. 62 grammes) of unprepared madder. On increasing the quantity of acid it was found to remove the mordant, and render the dyeing operation impossible. 31 grammes of olive oil soap, and 62 grammes of madder, only produced a very feeble color.

The same quantity of glue dissolved in water, and 62 grammes of madder, produced but a dull light red. This result was surprising, inasmuch as this mixture was recommended by *Berthollet*, as being almost as favorable to the operation as nut-galls, and had been frequently employed at Chantilly, for making carpets, the blue ground of which changed whenever the precaution was not taken of adding to the dye-bath 31 grammes of glue for every 500 grammes of madder; it was not observed that by this addition a larger proportion of coloring matter was required. From these facts we may conclude that the contrary result, obtained in our experiment, was solely owing to our having used gelatine, the weight of which is half that of the madder.

186 grammes of a mixture composed of 31 grammes of Tuscany potash, 500 grammes of madder, and one quart of water, produced a very light pink tinged with lilac.

186 grammes of a mixture made with 31 grammes of slacked lime, 500 grammes of madder, and one quart of water, produced a very light yellowish pink.

186 grammes of a mixture made with 500 grammes of madder, and one quart of water, containing 31 grammes of sulphuric acid, at 66° Beaumé, furnished a very light pink, and carried off the mordant in several places.

31 grammes of chalk, and 62 of madder, furnished a very light dull red.

The substances were added to the dye-bath in large quantities, in proportion to the weight of the madder, in order to be able to judge more accurately of the action of each of them; but their comparative utility was lost sight of, as at least two of them, viz. chalk and glue, are known to be useful. These experiments are so delicate, that, in order to arrive at definite conclusions, mere experiments in the laboratory are not sufficient,—they must be made on a large scale.

Besides, many circumstances may alter the action of the substances added to the madder-bath for the purpose of drawing from it the

greatest possible quantity of coloring matter; at least one is tempted to believe this in consequence of the following experiments made for the purpose of discovering in what state nut-galls are most advantageously employed in maddering.

On mixing 31 grammes of pounded nut-galls, or sumach, with 62 grammes of madder, in 8 quarts of water, the alumina mordants dyed therein only take a dull brown color; whilst if, after dunging the fabric, it is passed for a quarter of an hour through a bath at 80° Reaumur, made with the same quantity of nut-galls or sumach, and afterwards dyed with the same quantity of madder as in the preceding experiment, a fine red is obtained, deeper than that of a third specimen, dyed in the same manner, but without having been previously galled. By adding a solution of nut-galls to the mordant before printing, scarcely any mordant remains in the fabric after dunging. It may be concluded from these facts, that the nut-galls only exert all their influence upon the coloring matter of the madder when combined, before dyeing, with the mordant previously fixed in the fabric by degumming. It is probable that in the first case, the galls hindered the dyeing operation by precipitating the coloring matter, and that in the second, it facilitated it by increasing the absorbent properties of the mordant. This would, perhaps, explain the well known fact, that fabrics dyed twice are always of a deeper and brighter color than those only dyed once, although the same quantity of madder be employed. In the third case, the galls prevented the mordant from being properly fixed in the fabric, because by its infusion it precipitated the salts of alumina. Wheat bran coarsely ground, mixed with the dye-bath, in equal quantity to the madder, will produce a tint of not half the depth of those obtained with the same quantity of madder alone; on the other hand, the white part of the fabric is much less charged with color, provided the precaution be taken of washing them immediately on coming from the dye; without which, the coloring matter will become fixed therein with such tenacity, that it is almost impossible to separate it. Dung added to the dye-bath produces the same effect as bran.

II. The most advantageous quantity of water to be employed with a given quantity of madder can only be determined by approximation; experience shows that 30 quarts are necessary for every pound of ordinary madder. No disadvantage has been found to arise either from increasing or diminishing the quantity of madder, relatively to this quantity of water, up to certain limits, beyond which the coloring matter will not unite with the fabric, as it is carried off by the excess of water, or retained by the mucilage of the madder, which prevents it from dissolving.

III. The degree of heat suitable for commencing the dyeing operation, is a matter of much dispute among practical men; some maintain that it must be as high as 30 or 40° Reaumur, while others, who form the majority, contend that it is better to dye with a cold bath: all, however, agree that it must neither be down to 0°, nor up to the boiling point. In order to arrive at a correct conclusion on this head, the following experiments were made. A piece of calico, perfectly

bleached, was cut up into pieces of about 16 inches long, and 10 inches wide, which were immersed altogether in pure acetate of alumina, at 10° Beaumé, for about five minutes, pressed, wrung by hand, and hung up in a rather moist drying apparatus at 15° Reaumur, during two nights and three days. The third day they were dunged at 65° Reaumur, and were then severally dyed in dye-baths, prepared in a copper-vat, with 8 quarts of pure water, and 31 grammes of the best madder, and stirred constantly the whole time with a small fir stick. The temperature of each bath was indicated by a thermometer.

No. 1 put in at 10° R. heated in 1 hour to 80°, and taken out.		These three specimens are of a uniform light red tint.
No. 2	20°	
No. 3	30°	
No. 4	40°	Of a uniform red but a richer color than the three preceding.
No. 5	50°	
No. 6	60°	
No. 7	70°	Deeper than No. 6
No. 8	80°	The same tint as No. 6

These experiments prove that it is better to commence the operation above 30° R. than under; this fact is corroborated by practical experience, which shows that great economy is effected in the madder by carrying the temperature up to 40° R.; moreover, that the most advantageous heat for commencing the operation is 70° R. It is, however, to be regretted that it cannot be employed on a large scale with facility, as the workmen are not able to fasten the pieces together, end to end, at so high a temperature, without burning themselves; it is besides probable that that degree of temperature would produce stains, especially for designs with a ground; the movement of the piece not being sufficiently rapid to plunge all parts of it into the dye-bath at the same time, the action of which would, no doubt, be almost instantaneous. It will be seen presently that this degree (70° R.) is also the most advantageous temperature at which to stop the operation; lastly, that the boiling point, far from being favorable to the combination of the coloring matter with the mordant, seems, on the contrary, to separate a portion of that which had already united with it.

In winter, during frost, it is customary to make the madder-bath lake-warm, because it is impossible to dye at 0° R., as the coloring matter does not dissolve properly. If the bath is too cold to speedily melt the small icicles adhering to the pieces (which must always be most carefully avoided, as frost effects the mordants), whitish stains will be produced wherever they existed.

IV. The duration of the operation of dyeing varies according to the colors to be produced; it is generally a single dip of three hours for reds, violets, and browns, and two dips of an hour and a half each for pinks, the fabrics being put in at 20 or 30° R., which temperature is raised to from 40 to 50° R. No attempt has been made to ascertain the time necessary for completely exhausting the madder by

means of the printed pieces, as this question relates to the chemical composition of the madder.

V. The effect of lowering the temperature of the dye-bath has been ascertained by means of samples prepared as in the preceding experiment. The madder-bath was heated, in a quarter of an hour, to the degree indicated, stirring it constantly; it was then removed from the fire, and left uncovered, for twelve hours, in stone vessels of equal size, to cool; at the expiration of which time, the bath was employed, as in the preceding experiments. In each of these experiments, 31 grammes of the best madder were used.

No. 1	heated to 10° R. and left at that temperature.	All these pieces were of the same light red tint.
No. 2	20°	
No. 3	30°	
No. 4	40°	
No. 5	50°	
No. 6	60°	
No. 7	70°	
No. 8	80°	This piece did not take the color, being scarcely stained.

We may conclude from this, that below the boiling point, the dye-bath may be lowered a few degrees, without the least inconvenience; but it is not so at 80° Reaumur, as the bath, if heated to that degree, and afterwards cooled, becomes useless. It would seem that the coloring matter then becomes insoluble; at any rate the water floating upon the madder (which is precipitated by cooling) is perfectly limpid, being scarcely tinged with an amber tint.

It would be interesting to know whether the coloring matter which disappears is absorbed by the ligneous matter, or retained by coagulated matter; the microscope would be very useful in this inquiry.

VI. The proportion of madder to be employed, to saturate a given quantity of alumina mordant, can only be ascertained with correctness when the coloring matter is separated, (as this varies according to the kind of madder, and even in different portions of the same, according to its age, its degree of dryness, the salts it contains, and the treatment it has undergone), and when a definite combination of that and the alumina has been effected. This I believe to be impossible, judging from eight experiments made with the precautions abovementioned, excepting that I employed an alumina mordant of less strength (2½° Beaumé), in order to obtain clearer tints.

The experiments were begun at a temperature of 12°, and were heated in an hour to 80° R., and kept at that temperature for a quarter of an hour; the pieces were then soaped for a quarter of an hour at 65° R., in 24 quarts of water, with 64 grammes of white soap, then brightened, in the same quantity of water, with a solution of tin in *aqua regia*, washed in running water, and soaped as before.

No. 1	31 grammes of madder	bright pink.
No. 2	64	light red.
No. 3	95	intensely bright red.
No. 4	126	deep red.

No. 5	157 grammes of madder	little more intense than No. 4.
No. 6	188	one-third deeper than No. 4.
No. 7	250	little deeper than No. 6.
No. 8	500	one-fourth deeper than No. 7.

These experiments would seem to prove that the quantity of madder necessary for dyeing a piece of calico about 50 yards long, by 1 yard wide, a fine red color, is about 76 lbs., but experience demonstrates, that from 20 to 24 lbs. suffice for obtaining the deepest red; therefore, in these experiments all the coloring matter was not extracted from the madder, which was to be expected, as the operation was performed in one-sixth of the time usually taken when working on a large scale.

Great difficulty is found in saturating the alumina mordants with coloring matter, if indeed they are ever completely saturated, from which I am led to believe that a definite combination of the coloring matter and the alumina does not exist, and that beyond a certain limit, the intensity of the color is not increased in proportion to the quantity of madder employed, but deepens less rapidly: this is proved by No. 8, the shade of which is only one-fourth deeper than that of No. 7, although the dye-bath was charged with double the quantity of madder.

To be Continued.

On the useful applications of the Refuse Lime of Gas-Works. By Thomas Graham, Esq., F. R. S.

I had lately occasion to examine the lime as removed from a dry lime purifier. The gas before reaching the latter had been washed with dilute sulphuric acid, which accounts for the absence of ammonia and cyanogen compounds. The lime had not been exposed more than a few hours to the air before it was operated upon. Still, to my surprise, it did not blacken an acid salt of lead, and contained no sulphuret of calcium. It was not dried, but analyzed in a damp state, exactly as it is sent out of the works to be used as manure.

Composition of Gas-Lime.

Hyposulphite of lime	12·30
Sulphite of lime	14·57
Sulphate of lime	2·80
Carbonate of lime	14·48
Hydrate of lime	17·72
Sulphur	5·14
Sand	·71
Water combined	8·49
Water (free)	23·79
	100·

With no more than a trace of ammonia and cyanogen.

The lime in the porous condition in which it is taken from the dry-

lime purifiers, absorbs oxygen so rapidly from the air as to heat, and hence the state of oxidation in which the sulphur is found. If the lime be very damp, or diffused through a quantity of water, as it comes from the wet-lime purifiers, then the absorption of oxygen is much slower. The fluid portion then contains in solution the bisulphuret of calcium of Herschel, which may be crystalized from it; and at first very little else.

After the first rapid absorption of oxygen, the further oxidation of the gas-lime is decidedly slow. A specimen kept in an open vessel, and repeatedly moistened and rubbed to powder when dried, was found after three months' exposure to retain 7 per cent. of sulphurous acid, besides all the free sulphur originally present. The hypo-sulphurous acid had entirely disappeared. Hence, if added to soil as manure, gas-lime must be powerfully deoxidizing, a property which will generally impair its utility.

It appears advisable, where the refuse-lime does not possess any value from ammonia, to dry it strongly, or roast it. It would thereafter consist of nearly equal weights of sulphate and carbonate of lime, and be in the condition most valuable as a manure.

Refuse-lime, such as was examined, may be recommended as a convenient and most economical source of the hyposulphites. The lime, after being taken from the purifiers, should be exposed to air for two or three days, till it loses all smell of sulphuretted hydrogen. The highly soluble hyposulphite of lime may then be dissolved out by little more than an equal weight of cold water. The solution may be evaporated at 120°, and the hyposulphite of lime crystalized out; or the solution, by adding carbonate of soda, converted into hyposulphite of soda, which is a more stable salt, may be evaporated at a higher temperature, and crystalizes more easily.

From the refuse-lime, one-sixth of its weight of crystalized hyposulphite of lime has been obtained in a state of purity by a single crystalization. When the gas is washed with sulphuric acid to remove ammonia, before being conducted into the lime-purifier, it yields the refuse-lime more suitable for this purpose. The preparation of the hyposulphites in quantity is becoming the more important, as besides their use in electro-plating and photography, they are likely to be applied largely to the extraction of chloride and bromide of silver from silver ores. Rep. Pat. Inven.

On some of the substances which Reduce Oxide of Silver and Precipitate it on Glass in the form of a Metallic Mirror. *By* John Stenhouse, Ph. D.

It has been long known that aldehyde, when heated in a tube with ammonia-nitrate of silver, reduces the oxide to the metallic state, and forms a brilliant coating on the inner surface of the tube. Three other substances, saccharic acid, salicylic acid, and pyromeconic acid, were also known to possess the same property, though the coatings which they yield are much darker, and therefore less beautiful than

those formed by aldehyde. This was the state of our knowledge previous to the announcement, about six months ago, of Mr. Drayton's process for silvering mirrors in the cold, by means of ammonia-nitrate of silver and an alcoholic solution of the oils of cloves and cassia.

I find that the number of substances which, especially when assisted by heat, give more or less brilliant coatings of reduced silver, is much greater than has hitherto been supposed. Thus grape-sugar forms a pretty brilliant mirror even in the cold. When unassisted by heat the mirror is rather slowly formed, requiring from six to twelve hours; but when a slight heat is applied it forms very readily in the course of a few minutes; the coating is much darker than that produced either by aldehyde or by Drayton's process. Cane-sugar also yields a mirror when assisted by heat, but none in the cold. Gum-arabic and starch also yield dark colored mirrors, but more slowly, and require considerable boiling: so do phloridzine and salicine. Oils of turpentine and laurel also give mirrors, but with still greater difficulty, the solutions requiring to be very concentrated. Resin of guaiacum acts in a similar manner.

Oil of pimento, as is well known, consists of two oils, one an acid oil, which is heavier than water, and forms crystaline compounds with the bases; this in the course of a few minutes, even in the cold, produces as brilliant a coating of silver as the mixture of the oils of cassia and cloves. The neutral portion of the pimento oil, which is lighter than water, does not reduce nitrate of silver even after long boiling. I could not succeed in forming metallic mirrors with cinnamic, benzoic, meconic, komenic, tannic, or pyrogallic acids, with gum benzoin, elemi or olibanum, with oil of rhodium or with glycerine.

Ingenious as Mr. Drayton's patent process certainly is, it labors under a very serious inconvenience, which I greatly fear will not be easily remedied. In the course of a few weeks the surface of the mirrors formed by his process become dotted over with small brownish-red spots, which greatly injure their appearance. The cause of the spots seems to be this—that the metallic silver while being deposited on the surface of the glass carries down with it mechanically small quantities of a resinous matter, resulting, most probably, from the oxidation of the oil. This resinous matter, which is interposed between the glass and the silver, in the course of time begins to act on the metallic surface with which it is in contact, and to produce the small brown spots already mentioned. If an excess of the essential oils is employed to precipitate the silver, the metallic mirror is much darker, and gets sooner discolored than usual. No doubt the alcohol present in the solution keeps up much of the resinous matter; still a little of it is almost always deposited on the silvered surface, and acts in the injurious way described. Ibid.

Prizes offered by the Society of Arts of London.

The Council of the Society for the Encouragement of Arts, Manufactures, and Commerce, under the presidency of his Royal Highness

Prince Albert, are about to introduce a variety of alterations into the rules and regulations by which it is governed, with a view to its more successful working in the accomplishment of its objects. The Society has it in contemplation, also, to apply for a charter to the same end. The following premiums are offered to public competition in the present year;—all competing objects to be delivered at the Society's rooms by the 15th of May. The Society's medal is added to each of the premiums:—

In the Sections of Agriculture and Chemistry.—A Prize of One Hundred Guineas for the invention of a mixture of materials for a wholesome, nutritious, and palatable Bread, to be sold at a low price, and used as an economical substitute for wheaten bread, biscuit, or potatoes. The materials suggested are sago, rye, wheat, maize, barley, beans, peas, oats, rice, beet-root, parsnips, &c.

In the Section of Fine Arts.—A Prize of Fifteen Guineas for a Water-Color Drawing, 8½ inches by 12 inches, of a Holy Family, suitable for engraving in wood, and specially prepared for printing in colors by wood blocks; the object being to produce, at a cheap rate, a good picture, which may find its way into humble dwellings. Prizes of Ten Guineas for models of a plain and cheap Earthenware Tea Service, in one color, consisting of Tea-pot, Basin, Milk-jug, Cup and Saucer, and Plate; for the model of a Tea Urn, of a small size; for the model of an Earthenware Jug, to contain a quart, with a Cover; and for the design or model of the Cover of a Bible, to be executed in relief, in raised leather or in wood, either by the new process of burning, or by the carving machine. Prizes of Five Guineas for the cheapest and most beautiful piece of Mosaic or Tile Flooring, one yard square; for a design of the most convenient, elegant, and cheap Washing Stand, Basin, and Ewer; for a small Geometrical Pattern for a cheap Kidderminster Carpet and Stamped Drugget; and for the model of an Earthenware Mug, to contain a quart, without a cover.

In the Section of Mechanics and Mechanical Arts.—Prizes of Ten Guineas for a simple and good method of applying Steam Power, directly, to propelling Vessels by the Screw; for an improved Landing Pier, for embarking and landing passengers, &c., by steamboats on tidal rivers; for a method of providing against injury and accident produced by the Noxious Vapours of Fusees and Explosions in Mining and Tunneling, by means of improved ventilating apparatus, or otherwise; and for a Mechanical Contrivance for "Coal Whipping," to supersede the necessity of men, nearly naked, destroying their health and shortening their lives by hoisting coals from vessels on the river. Prizes of Five Guineas for an improved Meter, applicable to measuring the quantity or volume of liquids passing through pipes under pressure on both sides; for a portable and compact Machine for Raising and Lowering heavy articles from carts while standing on the streets; for a Horse Shoe, adapted to the several kinds of pavement now in use; for an improved method of Preventing the Emission of Noxious Vapours from the Gratings of Sewers, which shall permit a free passage for the sewerage, and provide against bursting

the drains; and for effective Ventilation of Ordinary Rooms; without cold currents or complex apparatus.

In the Section of Manufactures.—Prizes of Ten Guineas for a method of Printing in Distemper by Blocks, so as to "keep register" more perfectly, and produce finer specimens of Art in Paper Hangings than by the ordinary methods; for the best application of Glass to the construction of Water-pipes, Tiles, and Drains; and for the invention and application of a Cheaper kind of Glass than any now in use. Prizes of Five Guineas for the best Machine for Cutting Wood into given forms; for the best imitation of Ivory, in Plaster Composition, for Models and Sculptures; and for the most elegant Design for a Stamped Table-cover in Woollen Materials.

In the Section of Colonies and Trade.—The Society's Gold Medal for the best applications of Machinery, as a substitute for manual labor in the various processes of Cultivation and Manufacture of Sugar, Cotton, and Coffee in our West India Colonies and the Mauritius; the Gold Isis Medal for the invention or importation of any Material, the produce of our Colonies, as a substitute for Hemp or Flax.*

Athenæum.

On a Specimen of Artificial Asbestos. By F. Penny, PH. D. *Professor of Chemistry in the Andersonian University.*

For a specimen of this substance, I am indebted to Mr. William Murray, of Monkland; and, for a very accurate analysis of it, to his son, Mr. Francis Murray.

It was found in a Blast Furnace, imbedded in the mass of matter which had collected at the bottom of the furnace in the course of two years and a half, and which is technically called the hearth; it was in a cavity, about 8 inches below the level on which the liquid metal rested, and was interspersed with distinct and beautiful crystals of titanium.

In all its general characters, this substance corresponds with asbestos. It is colorless, inodorous, and tasteless—and occurs in small masses, composed of extremely minute filaments or fibres, cohering longitudinally together. These fibres are very easily detached from each other—and are flexible, though not so much so as the common asbestos. They have a silky lustre, and are unattacked by sulphuric, nitric, or muriatic acid. They remain unchanged in the flame of a spirit lamp, and are fused with difficulty even with the blowpipe.

A preliminary examination having been made to ascertain the ingredients contained in the substance, ten grains of the longest and cleanest of the fibres were selected for analysis. This was the largest quantity that could be obtained free from adventitious matter. The process adopted was the one usually recommended for the analysis of insoluble siliceous minerals. The following are the results per cent:—

* These premiums are open for competition to citizens of all nations.

Com. Pub.

Silica - - - - -	72·50
Alumina - - - - -	9·00
Protoxide Manganese - - -	13·20
Magnesia - - - - -	2·00
Lime - - - - -	1·58
Iron - - - - -	2·65
	100·93

On comparing the above with the analyses that have been given of the several varieties of asbestos, we remark, that the artificial specimen contains about ten per cent. more silica, and that magnesia, of which there is twenty-five per cent. in natural asbestos, is replaced by the protoxide of manganese. Now, it is well known that the protoxide of manganese is isomorphous with magnesia, and hence this replacement of the one by the other, is at once explained. I apprehend the substitution of manganese for magnesia will be found much more frequent in the mineral kingdom when minerals are submitted to improved methods of analysis. The occurrence of asbestos in an iron furnace affords a beautiful proof of the igneous origin of this substance. —*Proc. Phil. Soc. of Glasgow.* Lon. Mec. Mag.

Production of Bar-Iron direct from the Ore.

Having had application from several correspondents for the particulars of a plan, for rendering bar-iron direct from the ore, patented about two years since, we now inform our readers that such patent was obtained by Mr. Booker, near Cardiff, the effect of which, according to the specification, is a saving of 50 per cent. in the iron, and the same in the fuel. A fully descriptive paper has already appeared in our columns; but, as the subject is one of importance, and at present exciting great attention, we append a brief review of the principal points. According to the old method, the refined pig-iron is suffered to get cold, is broken up into lumps, and then thrown into the puddling furnace; and the author's object is to simplify and accelerate the conversion of cast-iron from its crude state, into malleable, or wrought-iron, for which purpose the refinery, or furnace, is adapted to the various qualities, or descriptions, of cast or pig, which it may be necessary to use, by surrounding, or inclosing, the hearth with blocks of cast-iron, through which water may be allowed to flow, or not, as may be found expedient; and the blast being introduced through one, two, or three apertures, as usual, the refinery is connected with the reverberatory furnace, which is made of the requisite form and dimensions. The bottom of the body of the furnace, the grate, bars, and binding plates, and bars, are all formed of iron; the other parts of the furnace of fire-brick, clay, sand-stone, &c., as usual; in the neck, or near the flue, of the reverberatory furnace is an aperture, through which the iron, when it has become refined, or de-carburetted, is run in a fluid state, direct from the refining hearth into the puddling furnace, on each side of which is a door, so that two men can perform

the puddling at once, while, by the old system, only one is admitted. With respect to the refining, having thrown up the fuel, and produced the necessary heat, a charge of 9 cwt. of cast-iron is thrown on, melted, and refined in the usual way; when the refining process is complete, the whole charge is run off, in a fluid state, into the reverberatory furnace, which has already been heated to the proper temperature, and brought to a proper state, by throwing in a sufficient quantity of limestone and cinder; the men then regulate the heat in the proper manner, at the same time stirring and agitating it with bars and puddles, while the escape of the oxide of carbon, in a gaseous state, takes place, until the whole mass becomes agglutinated; the workmen then divide it into lumps or balls of a convenient size, and draw the charge from the furnace, passing the lumps to the squeezer, hammer, or rolling cylinders, or other machinery, used for compressing iron. In the refining furnace the scoria, or cinder, is produced, and drawn off as usual; but in the process which the iron undergoes in the reverberatory furnace, the author does not find that any cinder will be produced, —the cinder and limestone thrown in being for the protection of the various parts of the furnace exposed to the action of the fluid metal; but none need be drawn off. The author accounts for this, because the common furnace is so constructed, that the iron operated upon in it is exposed to a very rapid draught, or current of air, which rushes in at the grate at the back of the furnace, passing off into the body and stack at the head thereof; this is so great as to oxidise the iron, and transform a great portion of it into slag and scoria during the process of puddling, which process, moreover, is so slow, that the iron, consisting of only 3½ cwt., or 4½ cwt., is exposed to the heat and draughts for a full hour and a half; while the new furnace is so constructed, that the current of air admitted at the grate is broken, and its oxidising effects on the surface of the iron, while fluid, and upon the fibrous particles while they cohere, after the oxide of carbon has been expelled, are completely neutralized. That portion, therefore, of the charge which, in the common puddling furnace, is converted into slag or cinder, in the author's is not wasted or oxidized, but remains, and is converted into pure malleable iron. The saving in fuel he thus accounts for—in the common puddling furnace not more than 4½ cwt. of metal is admitted, and that in a cold and solid state; in his, double the quantity is admitted, and that in a melted and fluid state: it is, therefore, obvious, that the time, fuel, and labor, necessary for melting the iron are saved, and that double the quantity of iron is converted from a cast into a malleable state, within the same space of time.

Min. Jour.

On mounting Minute Algæ for the Microscope.

In describing the method pursued by Mr. Thwaites in the preparation of algæ for microscopical observation, I stated that the cells were made of gold-size. As this is however liable to be softened and redissolved by the gold-size employed in fastening down the piece of

thin glass, he found it advisable to look out for some more convenient substance.

He now uses two compositions, one suitable for very shallow, and the other for somewhat deeper cells. For the former he takes equal *measures* of finely-powdered lamp-black and litharge; a portion of this is rubbed down with equal parts of gold-size and black japan, and the cells immediately formed on the glass slides with a camel's hair pencil. As the composition hardens very rapidly, the cells should be made as quick as possible, and to save time and trouble, a good many should be made at once. If the mixture becomes too thick for use before all the intended cells have been made, a little more gold-size may be rubbed down with it, and this may be repeated if necessary, but the last-made cells will take longer drying than the first. Before the walls are quite hard, they may be flattened by pressing them with a piece of *wet* glass. If this is not done, it takes a longer time to grind down the irregularities of the surface, which is best effected by rubbing them upon a piece of wet unpolished marble.

For the deeper cells Mr. Thwaites finds nothing so good as marine glue, which must be melted and dropped on the slip of glass, like sealing-wax, then warmed and flattened with a piece of wet glass: what is superfluous must be cut away with a knife, so as to leave only the wall of the cell; should this become loose, it can easily be fixed by heating the other side of the slip of glass over a spirit-lamp and gently pressing. Before these cells are used, it is desirable to flatten them by rubbing gently upon a piece of wood and then upon the wet marble.

In using the cells, as small a quantity as possible of gold-size, of a thick consistence, should be laid on the wall of the cell, and also on the edge of the piece of thin glass; and in covering up the cells, gentle pressure should be employed in order to squeeze out the superfluous fluid.

It would be a very useful thing for travelers to take with them the proper ingredients for preparing the two solutions for fresh and marine algæ. A portion of each species of alga might then be preserved in small phials carefully sealed and ticketed, which may be mounted and observed at leisure. The benefit of such a practice has been strongly impressed upon me during the examination of some highly curious foreign algæ which have lost many of their distinctive characters in drying.

Mag. Nat. Hist.